Department of Agriculture and Marketing

1987

RESEARCH AND INNOVATIVE DEMONSTRATION REPORT

RESEARCH AND INNOVATIVE DEMONSTRATION COMMITTEE - 1987

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Horticulture and Biology Branch

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Agriculture Canada, Halifax

1987 Statistical Summary

Research Projects were funded from a number of sources. Some of these were at the discretion of the Committee while others were the result of individual initiative. A number of investigative projects are not included. The fund sources are as follows and may or may not be included in these statistics.

Source	Projects/ Grants	Funds
N. S. Dept. of Agriculture and Marketing	46	254,320.
Canada/Nova Scotia Development Agreement (ALFI)	15	259,907.
Federal Contracts through Agricultural Research Institute	11	109,360.
NSERC Grants	12	213,410.
Industry and Miscellaneous Grants	23	114,646.
Miscellaneous Research Contracts	8	254,522.
	115	1,206,165.

Readers are encouraged to contact the project leaders for further information. Inquiries concerning the overall program may be made through any committee member.

1987 RESEARCH PROJECT REPORTS
(BY DEPARTMENTS)

Project Number	Project Leader	Project Title
Agricultural Engineering		
87-04	D. A. Allen	Earth Tube Heat Exchangers
87-08	S. A. Madani	Subsurface Drainage System
*	J. F. Adsett	Evaluation of an Electronic Fertilizer /Seed Application Rate Control System
*	F. L. Desir	Mower-Conditioner Performance Analysis
Animal Science		
87-14	D. M. Anderson	Drying of Cereal Grains
87-16	M. L. Connor	Fox Production and Reproduction
87-21	M. L. Connor	Melatonin and Reproduction in Furbearers
87-22	N. L. Firth	Chicken Fat in Pig Feeds
87-51	D. C. Crober	Computerized Environmental Control
87-77	T. Tennessen	Improving Cage Design for Laying Hens
87-83	D. L. Patterson	Strain Differences and Prediction of Carcass Fat in Broiler Chickens
87-84	D. M. Anderson	Wet Versus Dry Feeds for Growth, Lactation and Reproduction in Foxes
87-91	T. Tennessen	Rearing Techniques for Silver Fox
87-92	D. M. Anderson	High Protein Feedstuff
87-101	D. C. Crober	Layer Performance
87-102	A. Lirette	Milk Production in Beef
87-103	A. Lirette	N. M. I. Forage Structure
87-104	D. L. Patterson	Digital Image Analysis of Animal Shape

87-106	T. Tennessen	Baseline Data on Fox Development
87-107	M. L. Connor	Leanness and Reproduction Performance in Swine
87-108	M. L. Connor	Assay for Melatonin
87-109	D. M. Anderson	Canola Meal for Sows
87-110	D. M. Anderson	Water Quality for Pigs
87-112	M. L. Connor	Ovulation Rate and Embryonic Survival in Gilts
*	M. L. Connor	Haemotological and Biochemical Values for Ranched Silver Fox
*	M. L. Connor	Ovulation Rate and Early Embryonic Survival in Gilts
*	D. L. Patterson	Digital Image Analysis of Cow Shape and Relationship to Type Evaluation
*	T. Tennessen	Fur Clipping in Ranched Silver Foxes - A Survey

Biology

87-03	M. G. Sampson	Integrated Control of Canada Thistle
87-52	M. G. Sampson	Herbicide-Pathogen Interactions in Quackgrass
87-68	J.-P. R. LeBlanc	Effect of Temperature on Predatory Mites on Apple
87-95	M. G. Sampson	Weed Control in Blueberries

Chemistry-Soils

87-67	A. R. Robinson	Corticosterone Levels and Layer Performance
87-73	P. Warman	Asparagus Yield and Nutrition
87-75	C. Miller	Direct Rapid Assay for Tritiated Water
87-85	P. Warman	Effects of Cover Crops on Subsequent Sweet Corn Growth and Soil Properties
87-94	J. Hoyle	Translocation of Fungicides

87-97	K. S. MacLean	Selenium Content

Economics and Business

87-93	K. G. Grant	Price Determination in Maritime Slaughter Cattle Market

Livestock Services

87-105	H. Jansen	Effect of Breeding System on Reproductive Performance of Broiler Breeders

Plant Science

87-06	J. S. Bubar	Cereal and Protein Crops
87-07	J. S. Bubar	Forage Crops
87-24	T. H. Haliburton	Vegetable Variety/Management Trials
87-25	R. Prange	Clonal Selection and Propagation of the Ostrich Fern
87-28	L. Mapplebeck	Differential Susceptibility of Crop Cultivars to Herbicides
87-30	H.-Y. Ju	American Ginseng Production in N. S.
87-46	R. W. Daniels	Turfgrass Evaluation and Management
87-70	J. Nowak	Germplasm Preservation by Freeze-Drying
87-87	H.-Y. Ju	Growth and Yield Component Study of Two and Three Year Cycle in Lowbush Blueberry
87-89	J. Nowak	In-Vitro Tuberization as an Indicator of Heat Stress Tolerance
87-90	T. H. Haliburton	Effect of Growth Regulators on Thiocyanate Content of Crucifers
87-96	J. Nowak	Somatie Embryogenesis in Red Clover
87-98	R. Prange	Propagation and Screening of Non-traditional Sources of Stress Tolerance in Solanum Species

87-99	C. D. Caldwell	Management of Spring Canola
*	H.-Y. Ju	Effect of Boron Foliar Spray on Thiocyanate Content and Growth of 'Early Snowball' Cauliflower and 'Imperial' Broccoli
*	H.-Y. Ju	The Effects of Paclobutrazol (PP333) on the Growth and Physiology of Lowbush Blueberry

Soils and Crops Branch

87-09	D. Mellish	Cereal Rate of Seeding Trial
87-111	D. Doohan	The Biology and Control of Coltsfoot

* Designates the report appears at the end of the regularly numbered reports.

TITLE: Integrated Control of Canada Thistle

LEADER: M. G. Sampson

OBJECTIVES:
1. To evaluate an integrated management program for Canada thistle in pastures.
2. To evaluate the potential of the herbicide Clopyralid (LONTREL) for Canada thistle control in pastures.
3. To evaluate the rust, Puccinia punctiformis and other organisms to use as a biological control.

PROGRESS:

Field Experiments:

Two experiments were set up in 1986 to evaluate different combinations of herbicides and mowing regimes. One site was in Eastville, Colchester County and the other was in Alberry Plains, Prince Edward Island. The experimental design was a split-plot factorial experiment with six levels of mowing had two rates of herbicides as well as a control without herbicides. Main plots were mowed in spring, mowed at flowering, mowed in late summer, mowed twice (spring and at flowering) and mowed three times (spring, flowering, late summer). Plots were also left unmowed as a control. In Eastville, the herbicide treatment was 2,4-D + Dicamba; in Alberry Plains Clopyralid was used.

Although the introduction of Urophora cardui (L.) Diptera: Tephritidae) as a biological control agent of Canada thistle can be successful in reducing flower production, this agent has not been effective in reducing weed populations. Studies were conducted in Nova Scotia and Prince Edward Island to evaluate integration of chemical, cultural, and/or biological control methods. Laboratory experiments to determine the effect of the herbicides dicamba, clopyralid, 2,4-D, and chlorsulfuron on U. cardui showed no significant differences in terms of fly emergence from sprayed galls ($p>0.05$). In a field experiment, spring applications of herbicides were not compatible with U. cardui because plants that did regenerate were too small at the time U. cardui was present in the field. However, spring mowing was compatible with U. cardui. In split-plot factorial experiments involving eight mowing levels and three herbicide levels, it was found that the most effective combination in reducing weed density was a spring plus mid-season mowing in combiantion with an application of 2,4-D plus dicamba at 3.37 kg/ha or clopyralid at 0.3 kg/ha.

Project 87-04

TITLE: Earth Tube Heat Exchanger

LEADER: D. Allen

OBJECTIVE: To purchase components and install an earth tube heat exchanger to supply thermally modified air both summer and winter to the farrowing facility NSAC swine unit.

To test the effectiveness of earth heat exchangers in a Nova Scotia climate.

To determine minimum depth requirements and maximum effective pipe velocities.

PROGRESS:

During the original phase 3 x 30 m x 250 mm solid tubes were placed 2.4 m below ground and were intended to supply tempered air to the farrowing room of the N. S. A. C. swine building. During the first year it was found that the vacuum created by the room exhaust fans was not sufficient to pull air through the tubes.

During 1987 the following modifications were completed:

1. The intake was modified so that positive air delivery was received from the air tube.
2. Gravity shutters were placed on the by pass.
3. A five speed fan was placed on the earth tube manifold which supplied air under pressure to the farrowing room.
4. Earth was excavated and more soil temp T couples were installed.

The intake system was operated during the late summer. Spot checks indicated 10 C^{o} cooling of ambient air entering at 26^{o}.

Data logging equipment problems delayed data collecting until March of 1988. The data is being analyzed.

TITLE: Cereal and Protein Crops

LEADER: J.S. Bubar

OBJECTIVE: To support the breeding programs aimed at developing grain crops for the Atlantic region. To evaluate cultivars for recommendation and licensing. To support other research and development projects by carrying out other small plot trials that are requested by Atlantic Advisory Committee members.

PROGRESS:

Details on individual trials appear in the regional data compilations.

The 1987 spring cereal and soybean trials yielded less than in the previous year and had a lower disease incidence. Coefficients of variability were low in most trials. One trial was damaged by groundhogs, which fortunately confined most of their activity to one replicate. The use of "birdlines" above trials helped reduce bird damage. Pigeons did not cause much damage due to the lack of lodging. The new pneumatic fertilizer spreader was used and appreciated for ease of use plus a uniform application.

Specific trials supported by this operating grant and regional progress to which the trials contributed are as follows:

(1) Maritime cooperative oat trial.
Marion continued to be highest yielding. Nova yielded slightly less. Q0199.60 was released as Capital by the Ste. Foy Research Station. It is better suited to Quebec and yielded slightly less than Nova or Marion in the Maritimes. Tibor hull-less oats does not equal hulled oats in yield.

(2) Eastern cooperative spring triticale trial. Several lines outyield Beaguelita. Earlier maturing lines are desired. This trial at Truro was the last of the spring cereals harvested.

(3) Maritime spring wheat screening trial.

(4) Maritime-Quebec spring wheat trial. Our screening trial provides an opportunity for the breeder at Charlottetown to eliminate lines which may lack wide adaptation. Spring wheat breeding represents about one-half of the breeding effort at Charlottetown. Belvedere continues to be the leading feed wheat in the region. Two sister lines have not outyielded it. A number of potential bread wheat lines are being screened. We also carry the regional trial that is required for recommendation and registration of new cultivars.

(5) Eastern cooperative two-row barley trial.

TITLE: Forage Crops

LEADER: J.S. Bubar

OBJECTIVE: Evaluation as required by the Advisory Committee on Forage Crops, Atlantic Committee on Crops to contribute to recommendations for the region and the registration of new cultivars adapted to the Atlantic provinces.

PROGRESS:

Details on individual trials are combined with those from other cooperators and appear in the 1987 Forage Evaluator's Report.

New Trials of alfalfa and timothy were established in 1987. Both have satisfactory stands entering the winter in spite of the extreme drought in mid-summer. The new plot seeder provides firm seedbeds following seeding that may contribute to our successful establishment under adverse conditions.

O.A.C. Minto alfalfa ranked first in trials seeded in 1985 and 1986. Both trials suffered from winter damage and the stand on the 1986 seeding is variable. In spite of variability, OAC Minto was significantly better at the 5% level over Saranac in the 1985 seeding and over six of the other twelve entries in the 1986 seeding.

Renova red clover was significantly higher yielding than all other entries in trials seeded in 1985. This persistent, early red clover is not yet registered for sale in Canada.

A hybrid of meadow fescue x perennial reygrass named "Prior" is high yielding in our trials and has good quality in our regional miscellaneous grasses trial. Prior outyielded the other hybrids (Kenhy and Johnstone) and all perennial ryegrass entries in the trial at N.S.A.C.

A trial of annual plow down crops was seeded in mid-June under barley and alone. There was little growth under barley. Angelica phacelia produced 5 t/ha alone, which was double the yield of Florex red clover or Nitro alfalfa.

Progress was made towards participation in the region forage breeding (NE-14) project to encourage development of new cultivars adapted to other regions. Requests are anticipated to undertake field evaluation of materials in that program.

Progress with perennial forage evaluation should improve if a uniform area of good plot land can be obtained on a long-term basis.

Project 87-08

TITLE: Subsurface drainage system performance study

LEADER: Ali Madani and Peter Havard

OBJECTIVE: To evaluate the performance of a subsurface drainage system on a Queens soil type.

PROGRESS:

The objective of the research is to monitor the water table drawdown and outflow (discharge) from tile drainage plots made up of 6, 12 and 24 m spacings on a relatively flat land. The soil was surveyed by a soils specialist and a map was prepared for the site (enclosed). There was not a homogeneous soil present for the entire site, but the majority of it consisted of Queens and Debert with a shallow compact till layer between 30 to 50 cm. A simple rain gauge was instlled in the farm to record the rainfall amounts during each storm. In April the farmer insisted that all stakes and piezometers be removed to facilitate plowing. In mid May piezometers were all reinstalled with the tops of the tubes slightly below the ground surface, so as not to interfere with the field operations during the harvesting of the crop. Upon the installation of these tubes, the site was surveyed to record the elevation of each tube and the ground contour.

Due to an abnormally dry summer monitoring of the test plots was minimal. Monitoring of the outflow and water table heights was carried out during and after each storm. This was carried out from early fall until freeze up.

Data indicated the presence of a perched water table. The water table fluctuation in both long and short tubes was very erratic and it is difficult to make conclusions from it. Wetting and drying, and freezing and thawing have apparently improved the soil structure to an extent that the outflow from the tiles increased from 1986.

The amount of data collected in 1987 were limited dur to a dry summer and due to an unusually early snowfall. In order to effectively evaluate the performance of the system more data should be collected.

FUTURE PLANS:

In 1988 we plan to continue monitoring the system. The outflow of the 24 m spacing on the east side of the field will be monitored continuously using a potentiometer-pully-data logger system. The remaining outflow-water table draw down data will be collected manually.

Legend for soils of the Robinson farm

SYMBOL	NAME	DRAINAGE	PARENT MATERIAL
DRT	DEBERT	IMPERFECT	COARSE LOAMY TILL
QUE	QUEENS	IMPERFECT	FINE LOAMY TILL

EXPLANATION OF MAP SYMBOL

Depth to Compact Subsoil
|
|
QUE22----Partical Size Above Compact Subsoil

C ----Slope Class

SLOPE CLASSES

SYMBOL	% SLOPE
B	0-2
C	2-5
D	5-9

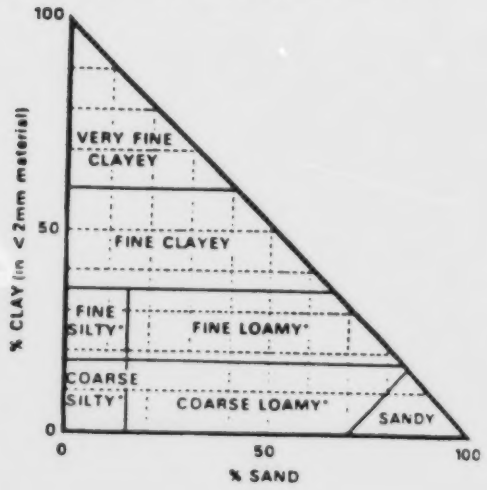
DEPTH CLASSES

NUMBER	DEPTH RANGE
2	20 - 50 cm
5	50 - 80 cm
8	> 80 cm

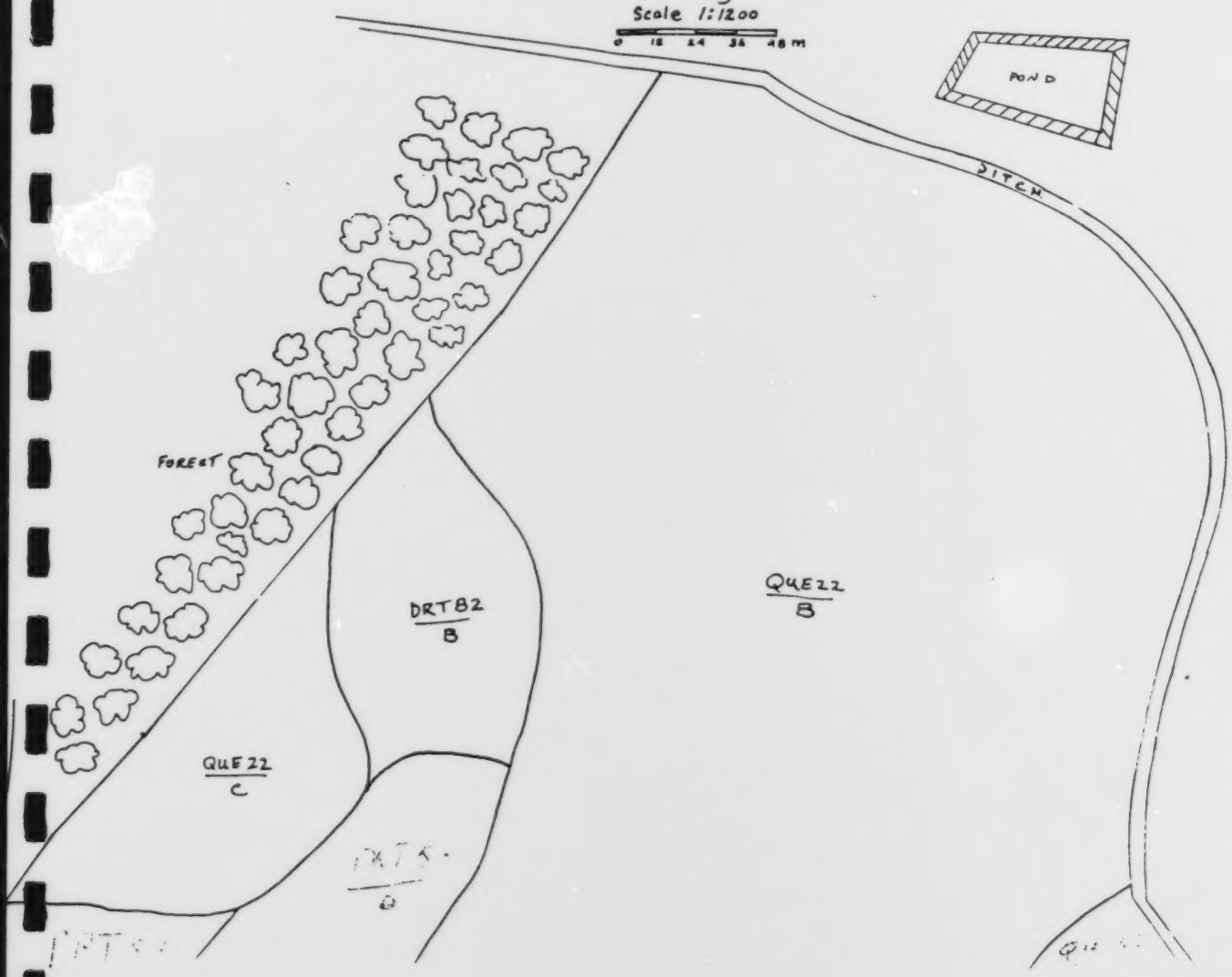
PARTICLE SIZE CLASSES

NUMBER	CLASS
0	Fine Loamy
2	Coarse Loamy

FAMILY PARTICLE SIZE TRIANGLE



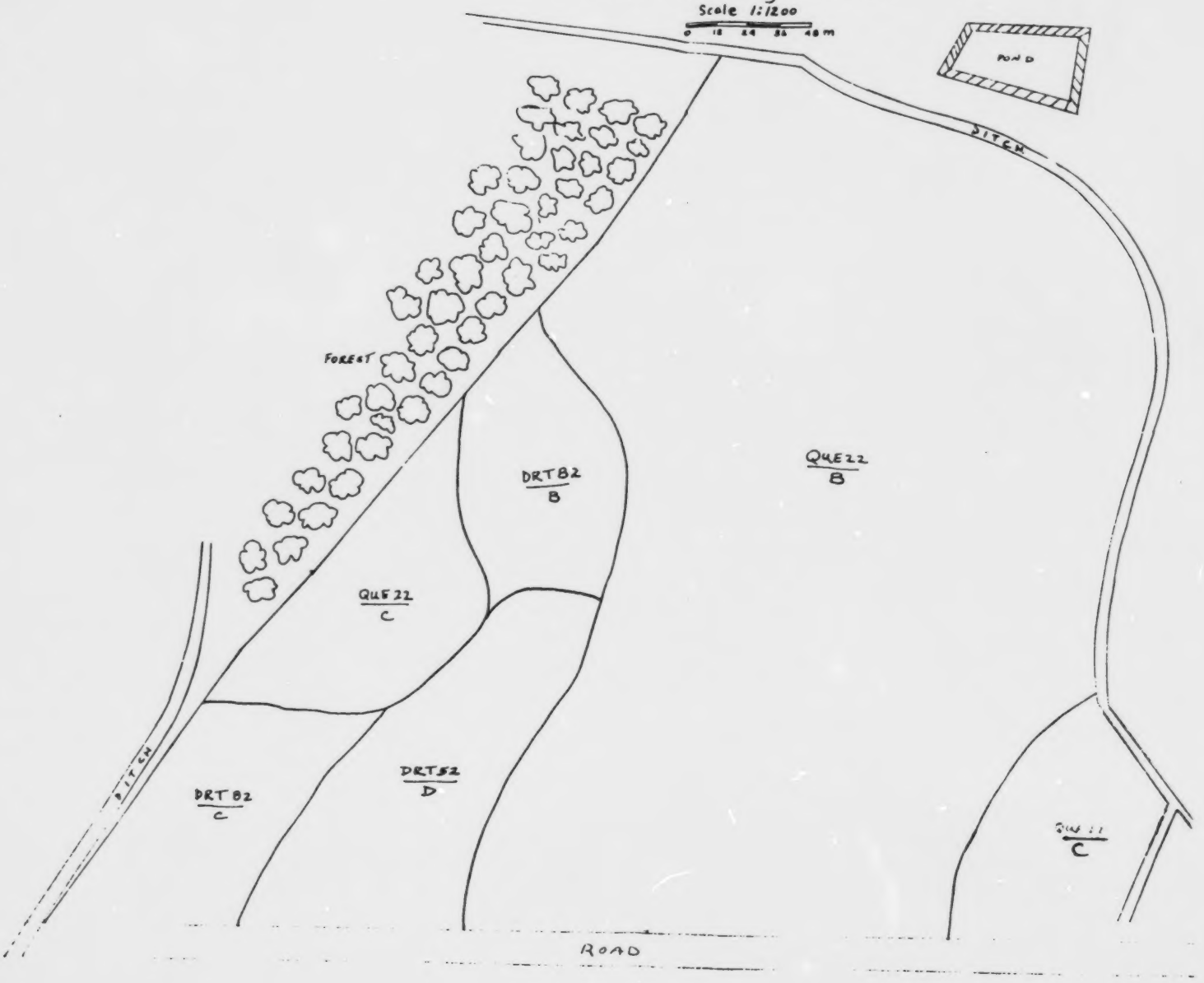
SOILS OF THE
Robinson Farm, North Salem
Tile Drainage Plot



SOILS OF THE

Robinson Farm, North Salem

Tile Drainage Plot



Project 87-09

TITLE: Cereal Rate of Seeding Trial

LEADER: Dr. Claude Caldwell

OBJECTIVE: To evaluate the response of six grain types to a range of seeding rates while utilizing ICM production techniques.

Winter and spring wheat, spring triticale, 6-row and 2-row barley, hulless oats will be planted at seeding rates from 100 seeds/m^2. All seeding rates will receive adequate nitrogen fertility for the species, foliar disease control and anti-lodging materials where necessary.

PROGRESS:

The second os three years of this project was conducted as proposed with the addition of hulless oats being included along with 2 and 6-row barley, spring wheat, spring triticale and winter wheat. Disease levels were kept low with the disease control program as well as due to low disease pressure weather conditions. No lodging occurred in any treatments.

Rodeo and Leger reached the maximum number of plant/m^2 with a seeding rate of 500 seeds/m^2, while Beaguelita showed no significant increase in plants/m^2 above a seeding rate of 300 seeds/m^2, while Max required 600 seeds/m^2 to reach its maximum plant establishment. (Appendix I).

All of the species reached the maximum number of heads/m^2 with a seeding rate of 400 seeds/m^2.

The Rodeo and Beaquelita gave the highest grain yield at the 500 seeds/m^2 seeding rate. Max showed no significant statistical yield increase above 200 seeds/m^2, however, it tended to yield highest at the 400 seeds/m^2. The leger did not respond greatly to seeding rate but there was a very large difference in 1000 k wt with a 1000 k wt of 43.7 gms/1000 at the lowest seeding rate and was reduced to a low of 33 gms/1000 at the 600 seeds/m^2 seeding rate.

Dry conditions during grain fill limited kernel filling and possibly limited the yield potential, particularly of the high population treatments. A better indication of the response to seeding rate is seen by combining the two years results which are shown graphically. In both years disease pressure was kept low and no lodging occurred. The yield response to seeding rate was somewhat different between years. A third year of this study will be very helpful in establishing more concrete seeding rate recommendations when diseases and lodging are not a limiting factor.

It is planned the project will continue as proposed to complete the third year to strengthen the Database. At the completion of this trial, it will be possible to make sound recommendations relative to seeding rate of these cereal species when the limitations of disease pressure and lodging are removed.

APPENDIX I

Mean Separation of Significant Effects of Seeding Rate

Plants/m^2

Seeding Rate Seeds/m^2	Rodeo	Leger	Max	Beaguelita
100	86 d *	125 d	124 d	140 c
200	128 c	221 c	211 c	197 bc
300	162 c	321 b	263 c	249 b
400	221 b	326 b	317 b	389 a
500	294 a	434 a	371 b	377 a
600	294 a	488 a	488 a	445 a
LSD	38	70	54	

Heads/m^2

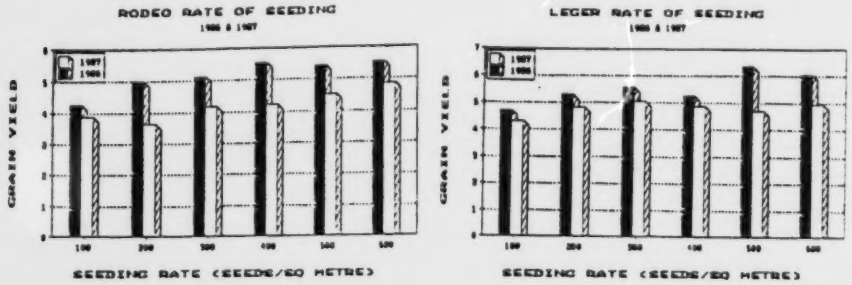
Seeding Rate Seeds/m^2	Rodeo	Leger	Max	Beaguelita
100	293 b	194 c	233	195 c
200	297 b	236 bc	272	273 bc
300	317 b	192 c	300	262 bc
400	363 ab	338 ab	315	305 ab
500	362 ab	350 a	396	353 ab
600	429 a	389 a	372	374 a
LSD	73	105	NS	91

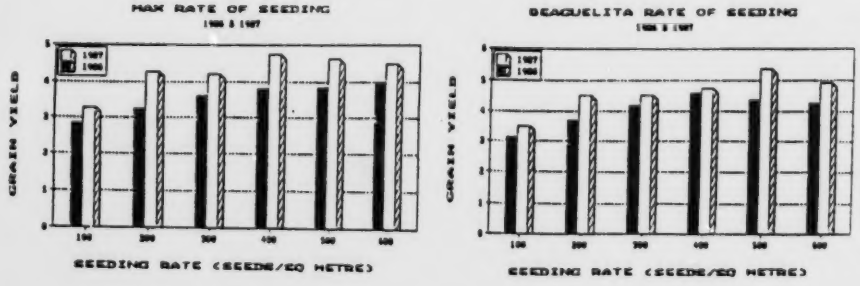
Grain Yield (t/ha)

Seeding Rate Seeds/m^2	Rodeo	Leger	Max	Beaguelita
100	3.89 cd	4.30	3.32 b	3.52 c
200	3.65 d	4.32	4.31 a	4.49 b
300	4.19 bc	5.05	4.22 a	4.52 b
400	4.20 bc	4.86	4.75 a	4.75 b
500	4.53 ab	4.69	4.64 a	5.37 a
600	4.96 a	4.96	4.51 a	4.95 ab
LSD	0.43	NS	0.52	0.56

* Numbers followed by the same letter are not significantly different at the 5% level according to Duncans Multiple Range Test.

EFFECT OF SEEDING RATE ON YIELD OVER 2 YEARS 1986 & 1987





Project 87-14

TITLE: Effects of Post Harvest Drying of Cereal Grain

LEADER: D. M. Anderson

OBJECTIVE: To demonstrate the effects of drying grain at various temperatures - 50°C, 90°C and 130°C on the nutritive value of cereals fed to broiler chicks.

To evaluate the effects of post harvest drying of cereals on the protein quality of barley, wheat and hull-less oats.

PROGRESS:

Recent trends in batch drying cereal grains has resulted in the use of temperatures in excess of those recommended for drying grain to be used as seed. It is well known that excessive heat treatment to protein particularly in the presence of carbohydrates will reduce the availability of lysine. This project using 110, 3 week old weanling rats was designed to show the effects of heat treatment on the protein quality of barley, wheat and hull-less oats. Protein efficiency ratio (PER) was used to compare protein quality. The protein quality of wheat was generally poorer than barley or hull-less oats (Table 1). As drying temperature increased above 90°C a significant reduction in PER was observed. There were similar effects on all grains as heat applied in drying increased. Wheat was not as good as barley or hull-less oats even at the lower temperatures.

Commercial type diets were compounded containing the grains dried at various temperatures and formulated to contain 23% crude protein and approximately 2870 to 2970 Kcal metabolizable energy with the grains comprising the only cereal in the diet. These diets were fed to 180 day-old broiler chicks in a brooder unit until the birds were 3 weeks old. Growth rate and feed consumption were recorded weekly and feed to gain (F/G) determined on a weekly interval. Feed consumption was unaffected by heat treatment (Table 2) and grain species. Although the temperature of drying was not a cause for reduced weight gain or feed efficiency, those chicks fed hull-less oats grew slower than when barley or wheat were the cereals in the diet. F/G was significantly poorer when hull-less oats was fed compared to wheat or barley. Wheat fed chicks had significantly better F/G than barley fed chicks. There does not appear to be a consistent and clear affect on the chicks of the poorer protein quality (PER)found in the cereals dried at higher temperatures. The reasons suggested for this are that the PER test with rats is a more critical evaluation of protein quality than is growth rate in the chick study. Secondly the blend, a cereal protein and soybean meal, fish meal protein in the chick diets may compensate for the reduction in quality of protein in the cereal grains. Thirdly the other nutrients in the cereals provided in the diets may not have been consistently adversly affected by the heat treatment. There is a tendency for F/G by chicks fed hull-less oats

to be poorer at the higher temperature. This may be related to the higher oil content in the hull-less oats compared to the other cereals. The heat application on the oil in the seed may have caused changes in fat quality that is responsible for the poorer F/G.

Table 1. Protein quality of cereals subjected to 50°C, 90°C or 130° in post harvest drying.

Grain	Drying Temperature	Protein Efficiency Ratio	
		Week 1	Overall
Barley	50	2.06^{c}	2.04^{c}
	90	2.01^{c}	2.24^{c}
	130	0.09^{a}	0.11^{a}
Wheat	50	1.32^{b}	1.30^{b}
	90	1.20^{b}	1.37^{b}
	130	0.24^{a}	0.11^{a}
Hull-less Oats	50	1.93^{c}	2.22^{c}
	90	2.05^{c}	2.11^{c}
	130	0.54^{a}	0.65^{a}
Casein*	--	2.54	2.67
Temperature	50	1.77^{b}	1.93^{b}
	90	1.76^{b}	1.85^{b}
	130	0.39^{a}	0.30^{a}
Grain	Barley	1.74^{b}	1.53
	Wheat	1.14^{a}	1.28
	Hull-less Oats	1.51^{ab}	1.69

a-c means within main effects having different post-scripts are significantly different ($P<.05$)

* Casein diet included as a reference.

Table 2. Growth and feed consumption by chicks from day old to 3 weeks of age fed diets using cereals dried at various temperatures.

(Units)		Feed Consumption (g/chick/day)	Weight Gain g/chick/day	Feed/ Gain
Grain	Barley	48.2	32.3^{b}	1.49^{b}
	Wheat	47.7	33.8^{b}	1.41^{a}
	Hull-less Oats	44.7	27.8^{a}	1.61^{c}
Temperature	50	47.4	32.2	1.47
	90	45.9	30.7	1.50
	130	47.3	31.0	1.54
Barley	50	47.8	32.1	1.49^{ab}
	90	46.9	31.9	1.47^{ab}
	130	49.9	33.0	1.52^{ab}
Wheat	50	47.8	34.2	1.40^{b}
	90	47.6	33.5	1.42^{b}
	130	47.7	33.6	1.42^{b}
Hull-less Oats	50	46.2	30.3	1.53^{ab}
	90	43.2	26.7	1.62^{ab}
	130	44.7	26.4	1.68^{a}

a-c means within columns within main effects having different post-scripts are significantly different ($P<.05$).

Project 87-16

TITLE: Semen Processing and A. I. in Silver Fox

LEADER: M. L. Connor

OBJECTIVES: To investigate and evaluate methods of semen processing for freezing silver fox semen

PROGRESS: The objectives of the project (Fox Production and Reproduction) with A.I. techniques and semen processing are ongoing at the time of this proposal. Results from last years project were beneficial for comparing semen extenders; comparing semen production of males throughout the season; for gaining more experience with A.I. in fox; and for freezing semen and testing post-thaw viability. (progress on photoperiod reported elsewhere - note with regulation of reproduction).

Of the 19 vixens inseminated artificially 78% of those with EYC extender whelped whereas only 25% of those with CUE+ extender whelped. One of two vixens inseminated with frozen semen had a litter. The experience and knowledge also contributed to the ability to provide confident instruction at an AI course for fox producers in January, 1988.

This year sees a continuation of the semen extender evaluation, A.I. techniques and freezing of fox semen. The loss of the experience and knowledge of Mr. D. Cameron with freezing techniques has necessitated more personal involvement in this aspect.

One area of practical fox AI involves the use of frozen semen. To this end, ability to successfully freeze and thaw fox semen is extremely important to growth of the fox industry. Local (regional) rancher interest is keen.

It is proposed that this project be renewed. The primary aim will be to refine the freezing/thawing techniques for fox semen and to optimize viability and post-thaw fertility. Incorporated into this should be the A.I. of 15 vixens.

Project 87-21

TITLE: Melatonin and Reproduction in Furbearers

LEADER: M. L. Connor

OBJECTIVE: To confirm and extend observations made during 1986-87 and

1. to monitor plasma levels of melatonin throughout the year in mink and fox;
2. to extend observations on efficacy of melatonin implants during the growing/furring phases;
3. to examine how melatonin during the furring period influences reproductive performance.

PROGRESS:

Ninety fox pups were allotted equally to one of 3 treatment groups: 0, 8 or 12 mg of melatonin. The implants, administered S.C. on July 8, were from two separate companies. Animals were balanced across treatment for sex and diet. Monthly weights and feed consumptions were recorded. Blood samples were collected from a representative sample of pups once per month. Fur development and growth were observed and animals not to be kept were pelted when prime. Though the weight gain appeared more rapid for the 12 mg implanted animals, the total feed consumed and final weight at prime were not significantly different from the 8 mg and control (0 mg) groups. Most of the melatonin implanted animals were prime October 26, a good five to six weeks before the control animals. The mean ($\pm$SD) of total feed consumed was 33.8 ($\pm$12.3) kg (12 mg implant); 31.6 ($\pm$9.4) kg (8 mg) and 39.8 ($\pm$12.5) kg. These were not significantly different.

Pelt quality was good. However, there were 16% slightly off colour in the 12 mg group and 30% in the 8 mg group, compared to 7% in the controls. Some of these were a result of not pelting as soon as possible when the animals were prime.

Of the 12 animals kept for reproductive purposes, the 4 males had normal sperm production by early-mid December. Most of the 8 females kept for reproduction showed proestrus signs by mid-late December. Three animals came into estrus at the normal January time and 2/3 whelped normal healthy litters.

Twenty-six mink kits were similarly implanted with melatonin. The implanted animals grew more rapidly initially but were not demonstrably larger at pelting. Prime was misjudged and animals were pelted a bit early. Males kept had good sperm evaluations and females mated normally.

Project 87-22

TITLE: Feed value of chicken fat in swine diets

LEADER: N. L. Firth

OBJECTIVE: To see if chicken fat, a cheap byproduct available in parts of Atlantic Canada, can successfully be used in swine diets in place of tallow, a standard additive.

PROGRESS:

One hundred-twenty pigs were fed from 20kg to market weight (for about 4 months) on diets containing 3% or 6% chicken fat, 3% or 6% tallow, or neither.

Carcass grades were recorded at slaughter. Fat samples were taken at slaughter and analyzed for rancidity and fatty acid composition. Metabolizable-energy value to chicken fat was measured with rats.

RESULTS:

All animals have been marketed and lab work is complete. Data have not yet been analyzed, but so far it seems that there is no objection to the use of chicken fat in swine diets.

Project 87-24

TITLE: Vegetable Variety/Management Trials

LEADER: T. H. Haliburton

OBJECTIVE: To determine the performance of new "super-sweet" hybrid cultivars of sweet corn under various management systems such as pre-sprouting and the use of plastics.

To further observe the cultivar/planting date/ interaction of the oriental vegetables: chinese cabbage, winter raddish.

To observe the performance of promising new head lettuce cvs under local conditions.

To determine if multi-transplant units are practical with sweet Spanish onion cultivars.

PROGRESS:

Staking tomatoes:

Three cultivars of staked tomatoes were grown at 3 spacings on black plastic mulch. The effect of mulch, spacing, and cultivar on yield and water stress related disorders is being presented as a PS450 project. Early Cascade gave the best performance.

Winter radish (Daikon) storage:

The hybrid cultivars H. N. Cross and April Cross were stored in 0^{o} to 3^{o} C storage from September to January in (a) burlap, (b) perforated plastic, or (c) solid plastic bags holding 6 to 8 kg each. Perforated plastic was most satisfactory with excessive rotting in solid plastic and shriveling in burlap. The storage life of these cvs. in this storage environment is apparently less than four months. H. N. Cross retained quality longer.

Crucifers:

Glucosinolate levels in Chinese cabbage and winter radish as affected by growth regulation chemicals was investigated. This will be presented as a PS450 project. (Cooperative project with Hal Ju).

Chinese cabbage:

Transplanted vs. direct seeded at several planting dates. Field grown transplants were unsatisfactory under these conditions. Bolting increased with early field planting.

Minor vegetables:

Spacing trials with Florence fennel and leeks were inconclusive under the dry field conditions. Flowering cabbage and kale, and bok choy cultivars were observed and visual differences noted. These were also used for classroom purposes.

TITLE: Clonal selection and propagation of the ostrich fern

LEADER: R. K. Prange

OBJECTIVE: To evaluate the performance of selected ostrich fern populations in a field nursery and propagate superior plants.

PROGRESS: The 1987 growing season was substantially better than the 1986 season and this influenced the performance of the field populations. Total frond dry weight (g) per plot (1 x 2 m) increased from a mean of 260 in 1986 to 537 in 1987. The yield of fiddleheads picked in the spring of 1987 was down, compared with the 1986 yields, in terms of both dry weight and fresh weight. The mean fresh weight yield of fiddleheads was 36 g/m^2 in 1987 and 53 g/m^2 in 1986.

In the picking experiment, only 32% of the picked portions of each population produced frond dry weights greater than the non-picked portion. This percentage has declined from ca. 66% in 1985 to 48% in 1986 and 32% in 1987, suggesting that repeated pickings can gradually reduce frond production.

Propagation of the five superior clones (78-6, 78-10, 78-15, 81-12 and 81-40) was successful. Approximately 500 plants were propagated through rhizome cuttings in the greenhouse. Aseptic in vitro callus culture, initiated in 1986, was successful in three of the five clones and plantlets with shoots and roots have been produced from the callus cultures. Although the invitro method was successful, it was technically more difficult than the rhizome cutting method and it can possibly produce somatic mutations. The three in vitro cultures are now part of the tissue culture collection in the Department of Plant Science.

Since this was the last year for this project, field plants of the five superior clones have been placed in a demonstration field plot, maintained by the Department of Plant Science. Plants from the other 91 clones have been moved to a commercial plantation operated by Mr. Peter Christiansen, RR#1, Bass River, N.S. B0M 1B0.

Project 87 - 28

TITLE: Differential Susceptibility of Crop Cultivars to Herbicides.

LEADER: L. R. Mapplebeck.

OBJECTIVE: To develop an accurate technique which can be used to quickly and economically screen for herbicide susceptibility in crop cultivars.

PROGRESS: Soybean Cultivars/Metribuzin Susceptibility Study. A technique using chlorophyll fluorescence was developed to screen soybean cultivars to determine their relative susceptibility to metribuzin. Two metribuzin susceptible cultivars - Baron and Maple Amber, and two metribuzin tolerant cultivars - KG20 and Maple Isle, were selected and a series of experiments were undertaken in the developmental part of the study. Thirty-six soybean cultivars were then screened, once a satisfactory technique was developed. Plants were grown in flats of perlite in a greenhouse and fertilized daily following emergence with 200 ppm 20-20-20 liquid fertilizer. At 11 or 12 days from seeding, plants were placed in a growth chamber and treated daily with 0.1 ppm metribuzin in the fertilizer solution. Chlorophyll fluorescence readings (terminal values) were taken for a 10 second duration on the upper side of one of the two unifoliate leaves of each plant. Leaves were excised; plants were not dark adapted. Chlorophyll fluorescence readings of the treated plants were compared to chlorophyll fluorescence readings of untreated plants and the data expressed as percent increase in chlorophyll fluorescence. The more susceptible the cultivar, the higher the percent increase in chlorophyll fluorescence. The optimum separation of susceptible and tolerant cultivars occurred 4 days following the initial herbicide treatment. Percent increase in chlorophyll fluorescence data was significantly correlated to percent decrease in fresh weight data ($r = \pm 0.85$).

Potato Cultivars/Metribuzin Susceptibility Study - A technique was developed to screen potato cultivars to metribuzin. The susceptible cultivars Belleisle, Tobique, and White Rose and the tolerant cultivars Kennebec and Russet Burbank were used in the initial developmental work. Similar parameters as those examined in the soybean research were studied. The technique developed indicates susceptibility or tolerance one to two days following treatment; hence it is very fast. Fourty-five cultivars were screened for relative susceptibility to metribuzin and compared to the five cultivars listed above. Results indicate cultivars such as Rhine Red Grand Falls, Shepody, Caribe, and Avon are susceptible to metribuzin. Yukon Gold, Nipigon, Katahdin, Huinkel, F70021, Donna, Lemhi Russet and Nooksack are some of the tolerant cultivars. Many of the remaining cultivars examined were intermediate in response.

Strawberry Cultivars/Terbacil Susceptibility Study - A similar technique for screening strawberry cultivars for their susceptibility to terbacil was developed. The eleven cultivars examined are ranked in the following order of increasing tolerance to terbacil based on the results of this study: Annapolis - Kent - Cornwallis - Glooscap - Micmac - Bounty - Honeoye - Blomidon - Veestar - Sparkle - Redcoat.

Project 87-30

TITLE: American Ginseng (Panax quinquefolium L.) Production in Nova Scotia

LEADER: H.-Y. Ju

OBJECTIVE:

1. To evaluate the effect of soil fumigation prior to seeding

2. To test the effect of mepiquat chloride on growth of ginseng roots.

PROGRESS: In late October 1986, stratified ginseng seeds were planted in two beds in Plumdale and four beds in the N.S.A.C. orchard after fumigation with vorlex prior to seeding. Poor germination was observed in the following spring 1987. The causes are not determined; however poor stratification may be involved or may have been in part because of cold, wet and consequently drying soil conditions in the early season. Poor germination is a great concern to commercial growers because of economic loss from investment for seeding. Therefore a reliable seed source is very important in order to obtain good quality and properly stratified seeds.

In contrast with previous years, there were no disease and insect problems during 1987. This may be due to the fumigation of those plots with vorlex prior to seeding and also dry soil conditions during the growing season.

In October 1987, two year old ginseng roots were harvested from plots that were sprayed with mepiquat chloride (0, 10, 100 and 1000 ppm) in 1986. There were no significant differences in fresh weight, dry weight or percent dry matter of roots among the treatments.

Two additional units of shading structure were established in late fall 1987 and covered with woven black polypropylene which will be evaluated.

Project 87-46

TITLE: Turfgrass cultivar and mixture evaluation. Development of management programs for optimum turfgrass growth.

LEADER: R. W. Daniels

OBJECTIVE: Evaluation of turfgrass cultivars, both as pure lines and in mixtures for their overal performance. Promising new cultivars are evaluated with standard, recognized cultivars of a particular species. Standards for evaluation are those which are recognized by all turf researchers throughout Canada. Information from their performance may therefore be useful in licensing new cultivars in Canada. This programme is expanded to include high quality turfgrass mixtures, and overwintering ability of certain cultivars.

Using established turfgrass and by reestablishing new plots as required, evaluate and demonstrate (at field days, etc.) latest technology in turfgrass culture and management. Exploratory areas are in proper seeding and maintenance of turf.

Sod production in Nova Scotia presently exceeds 2,000 acres. Industry is self sufficient with no imports from outside region. Value of sod sold in excess of 2.0 million dollars per year.

With some 2,000 turfgrass areas (baseball, softball, athletic fields, golf courses, playgrounds, parks and lawn bowling areas in Nova Scotia), in addition to the homeowners, there is a very real need for proper management of turfgrass for specific areas and uses.

PROGRESS:

Non 2,4-D Broadleaf Weed Control in Turf:

Both liquid and granular (weed and feed) herbicides not containing 2,4-D were applied to established turf. Various rates and combinations of herbicides were used. Best results were obtained from the combination of Lontrel, Garlon, Dicamba and Chlorflurenol at medium applied rates. Several non 2,4-D chemical alternatives are available for adequate broad leaf wee control in turfgrass.

Treatments were applied to a two-year old stand of Kentucky Bluegrass. Date of application was July 7, 1987. Prior to herbicide application plots were fertilized with 0.5 kgs N/100m^2. Prominent weed species present were clover, mouse-eared chickweed, lambs quarters, wild mustard and yarrow. Plots were evaluated on days 6, 10, 13 and 42 after treatments. Measurements made were

efficacy (% weeds controlled), speed of kill (days) and phototoxicity (weed species controlled). No supplemental irrigation was applied to plots.

From day 3 onward it was obvious that the herbicide combination of Lontrel, Garlon, Dicamba and Chlorflurenol gave the best weed control. This chemical combination at a higher concentration did not result in better weed control.

Response from herbicides applied in granular form was slow due to presence of hot, dry weather. This indicates that herbicides applied in granular form must be 'watered in' soon after their application for best results.

Effect of Cultivar on Overwintering of Perennial Ryegrass:

Overwinter ability of ten perennial ryegrass cultivars was measured. High incidence of winter injury was recorded. Primary factor associated with winter injury was the formation of a thick layer of ice over the turf. It was formed during early January and persisted under a snow cover until April. At time of its melting in early spring, ammonia gas had accumulated between the ice and turf increasing the severity of harm to the turfgrass.

Highest incidence of winter injury occurred in non turf type varieties Caravelle and Linn. Improved varieties such as Manhattan and Pennant had least winter injury and exhibited best reacovery. This underscores the value of selecting an evaluation improved perennial ryegrass for commercial production.

Project 87-51

TITLE: Computerized Environmental Control and Flock Management

LEADER: D. C. Crober

OBJECTIVE: To develop a computer-based system for use in commercial poultry production facilities.

PROGRESS:

The system combines efficient environmental control with a sophisticated management reporting system which integrates information from both environmental and performance-related factors. A commercial proto-type has been installed in a caged layer section of the N. S. A. C. poultry unit and is now undergoing testing. A commercial site field test is scheduled to begin soon.

This system, developed in cooperation with Lifeline Software, Truro, N. S., is built around a PC-type computer and Opto-22 data acquisition and control hardware. Temperature and humidity are continuously monitored. Specialized software has been designed to economically optimize ventilation by analyzing the cost-benefit relationship, for each factor, of modifying the ventilation rate. Feed and water consumption are also continuously monitored; levels are compared to pre-set goals in concise summary reports that are produced automatically. Detailed information on both environmental and performance-related factors is stored by the system for later diagnostic use, as necessary.

Project 87-52

TITLE: Herbicide-pathogens interactions in quackgrass.

LEADER: M. G. Sampson

OBJECTIVES: To verify a technique involving slab gel electrophoresis and serological techniques for easy identification of intraspecific variation in clones of quackgrass collected from the field. This will be used to verify results obtained from herbicide tolerance trials established in the field.

To evaluate the potential of three fungal pathogens, used alone and in combination with herbicides, on the control of quackgrass and the effect of these pathogens on the efficacy of conventional herbicides. This will provide data required to obtain patents on three potential mycoherbicides for control of quackgrass.

To isolate and test phytotoxins produced by pathogens from quackgrass for their potential as mycoherbicides.

PROGRESS:

INTRODUCTION:

Agropyron repens (L.) Beauv. (quackgrass) has been designated by the Canada Expert Committee on Weeds as one of the most serious weed threats to Canadian Agriculture. Chemicals are the main method of control and most research currently being conducted is directed at chemical control. The weed, however, still continues to cause serious problems due to uneconomical control strategies and a lack of knowledge of the biology of the weed.

Previous research conducted by the applicant has demonstrated intraspecific variation in herbicide response between clones of quackgrass. This would be one possible explanation for inadequate control of quackgrass in some situations. This work also demonstrated that diseases on quackgrass could interfere with herbicide absorption, further reducing their efficacy. During the course of this and previous research, it was noted that, in the absence of herbicides, some fungal pathogens were successful in killing quackgrass. This effect was inhibited if herbicides were used. The pathogens involved have the characteristics of fungi that are currently used as mycoherbicides, which represents the latest advance in biotechnology in weed control. The development of these pathogens involves the issue of a patent and commercial development of the product. Identification of these pathogens cannot be publicized due to patent requirements.

PROCEDURES:

(a) Intraspecific variation:

Field trials established in 1987 confirmed results obtained in the greenhouse. These studies involved looking at several different clones treated with three rates of the herbicide glyphosate. There were significant differences between clones in mortality of shoots. These differences were not as great at higher rates indicating that more tolerant clones could be controlled at higher rates. Rhizome growth, particularly bud number, still appears to be an important factor.

Consultations with Dr. R. Singh (Agriculture Canada, Fredericton and Adjunct Professor, Dept. of Biology, N.S.A.C.) has provided a technique which would involve separating quackgrass protein by slab gel electrophoresis. This would dicate the genetic variation present within each clone. A band common only to herbicide tolerant biotypes would indicate the presence of an enzyme which could be responsible for the tolerance. This band could then be separated from the gel and used to produce antibodies which could be used in the ELIZA test. Any clones which contained these enzymes would be identified using the ELIZA test. Any clone collected from the field could be subjected to this test and tolerant clones identified without electrophoresis or spraying the clones with herbicides.

In 1987, the methodology for performing the electrophoresis was worked out. The technique for extracting proteins from rhizome and leaf tissue has to be refined. In addition protein separation was not as good as expected or else they were not staining properly. These problems have to be resolved in 1987. Despite these problems, there appears to be an extra protein band in those clones that have shown tolerance to the herbicide glyphosate. This must be investigated further.

(b) Control of quackgrass by Fungi and their interaction with herbicides.

Three pathogens were isolated and identified as occurring on quackgrass. One attacks the rhizomes and reduces rhizome production to zero. The other two pathogens are leaf spotting pathogens. The best media for growth of these fungi has been identified as well as spore concentrations which are required for infection. Two of the fungi are host specific. Field studies with these pathogens were not successful in 1987 because of the prolonged dry condition.

One of the pathogens on quackgrass also appears to produce a phytotoxin which will produce the same symptoms as the pathogen. If this toxin is host specific, then it has potential for use in a control programme.

(c) Plans for 1988:

Work in 1988 will continue to solve problems with the electrophoresis techniques encountered in 1987. As well, studies to identify herbicide tolerant clones will continue. Studies will also continue to evaluate the potential of these pathogens isolated in 1987 as mycoherbicides. This will involve more culture studies as well as inoculation studies on quackgrass and other plant species. The isolation of a damaging toxin would be a major breakthrough in the study of pathogen interactions on quackgrass and provide a compound to work with as a control measure. Studies will concentrate on isolating this toxin from cultures of the fungus and testing its specificity on various plant species.

JUSTIFICATION OF EXPENSES:

Employment of Assistants: This request includes salary for 20 weeks at the full summer student rate and salary for the remainder of the year at the winter casual rate. A major stumbling block to making significant progress on this programme is that full time technical help is not available for the whole year.

Materials, Supplies, etc.: Research supplies for this project are expensive. Large amounts of PDA, Lima Bean agar, nutrient broth and other media as well as large amounts of chemicals for electrophoresis are needed. In addition greenhouse supplies as well as plot supplies are required.

Travel: Travel funds are required for travel between the college and the plots, and for collecting trips of quackgrass clones and diseased quackgrass.

Incidentals: This is to cover any unexpected costs in supplies or repair costs for equipment.

Project 87-67

TITLE: The relationship between stress and performance of caged layers.

LEADER: A. R. Robinson and D. C. Crober

OBJECTIVE: To validate a radioimmunoassay (RIA) procedure for the determination of corticosterone in avian plasma. Use the RIA procedure to determine the corticosterone concentrations in blood samples collected by D. C. Crober in a projeect related to strain and housing effects on production of layers. To determine if a correlation exists between blood corticosterone concentrations, management variations and performance as well as genotype of laying stock.

PROGRESS:

An increase in steroid hormone output by the adrenal glands is a recognized response to stress. This project examined the relationship between plasma corticosterone level and performance of laying chickens housed at different stocking densities in cages of different sizes. Specifically, the housing environments were as follows: 1 bird per 20 cm (8") cage (frontage) and 2 birds per 20 cm cage; 2 birds per 25 cm (10") cage and 3 birds per 25 cm cage; 3 birds per 31 cm (12") cage and 4 birds per 31 cm cage. All cages were of the same depth and height. Two successive stocks of White Leghorns were used in the study. Each consisted of three experimental strain crosses. For both flocks, all stocks were proportionately represented in all cage formats. Egg production and mortality were monitored throughout a complete laying cycle. Blood samples were taken from the wing vein of a random sample of birds of each stock/cage size/stocking density combination during all trimesters for the first flock and during the final semester only for the second flock.

Plasma corticosterone levels were determined on these, by radioimmunoassay. For the first flock, corticosterone levels in all trimesters were significantly affected by both cage size and stocking density. Though not significant, differences in levels of corticosterone of the second flock followed a similar pattern. In both stocks, within each cage size, corticosterone level increased with increasing stocking density, and within each density, corticosterone level increased with cage size. In general, a similar cage size/stocking density ranking existed for costicosterone level as for mortality. Similarly, corticosterone level showed an inverse trend to that for egg production rate. Differences between stocks in corticosterone level at the various stages determined were not significant for either flock.

TITLE: Effect of temperature on predatory mites on apple

LEADER: Jean-Pierre R. Le Blanc, Ph.D., P.Ag.

OBJECTIVES:

To study the effect of temperature on the predatory mite, Typhlodromus pyri Scheuten (Acarina: Phytoseiidae), development rates and its density on apple cultivars in Nova Scotia. In Nova Scotia orchards the bionomics and life table data for T. pyri are a prerequisite for the implementation of IPM programmes. Therefore the objectives of this cooperative project with Kentville Research Station are to general field and laboratory derived data on the effect of temperature on development rates, fecundity and predation of T. pyri.

PROGRESS:

In the fall of 1966, twigs with a heavy infestation of European red mite winter eggs, Pononychus ulmi (Koch), were pruned from Delicious apple trees. Twigs were maintained in cold storage for the winter and removed daily over the experimental period to allow the red mite eggs to hatch. P. ulmi larvae readily emerged from the eggs after a period of eight days at 24° C and 70% relative humidity. Adult female T. pyri were collected from apple orchards in King's County in early May 1987, and placed on arenas. The smooth, black surface of the arena provided a substrate upon which the predators were easily observed. Escape was prevented by a water barrier. Newly emerged P. ulmi larvae were added to the arenas on a daily basis. Therefore availability of food was not a limiting factor.

T. pyri eggs were removed daily from arenas and placed individually in gelatin capsules. Capsules were randomly distributed in six growth cabinets set at different temperatures, i.e., 12°, 16°, 20°, 24°, 28° and 32° C., and a constant 80% relative humidity. Observations of the predators were made daily, and fresh prey was added to provide a minimum of 20 active P. ulmi per capsule. The duration of developmental stages was noted for each individual in the trial. Where the predators failed to reach adulthood, natural mortality was noted.

The sex ratio was calculated for the predatory mite counting the individuals which reached the adult stage. This was repeated for each of the above temperature regimes. Three replications of ten individuals each were made for each temperature setting. Blocks were established to verify the possible effect of seasonal variation on the rate of development and the sex ratio. These blocks were arranged in accordance with the date at which the eggs were laid. In this manner, the first block considered comprised of eggs from overwintered females. The two other blocks consisted of eggs oviposited in July and August respectively. This trial was completed during the fall of 1987.

Partial analysis of the data has been completed. T. pyri mites reached adulthood in 28, 19, 14 and 12 days, at 12°, 16°, 20° and 24° C. respectively. No T. pyri reached sexual maturity at 28° or 32° C. Highest survivorship was at 20° C. Although slight variations were observed, when the data from all trials are considered, the mean sex ration for T. pyri is 50:50.

This programme is now completed and a scientific publication is currently in preparation. We intend to use these life table data to run a simulation model and be able to predict the predation effects of T. pyri on its prey, the European red mite. A graduate student supported during this programme will submit a M.Sc. thesis to Dalhousie University.

Project 87-70

TITLE: Germplasm preservation by freeze-drying

LEADER: J. Nowak

OBJECTIVE: A large portion of the plant germplasm is maintained in the clonal form. The cost of its maintenance in field experiments is very high and there is always a risk that the material can be destroyed by the environmental factors. In vitro grown plantlets, their fragments, tissues or cells are being utilized more and more for long-term germplasm preservation. Cryopreservation (storage in liquid nitrogen) is being tested most commonly. There are problems, however, to regenerate plants from the liquid nitrogen stored cells or tissues. In this study we intend to attempt utilization of controlled freeze-drying technique for long-term germplasm maintenance.

PROGRESS:

Preliminary experiments with freeze-drying of preconditioned tissues of potato using standard freeze dryer (Edwards Vacuum) failed. We have learned that the pre-treatment of the plant material prior to freezing is as critical as the controlled freezing itself. The effect of a combination of cryoprotectants (DMSO, proline and sucrose) and environmental factors (temperature and photoperiod) on low temperature survival of the plantlets and frozen cells was tested. Two clones of white clover, Huia #5 (LT_{50} approx. -8.5°C) and Sonja #31 (LT_{50} 10-12°C) were used for hardening studies. It was found that 2°C, 8 h photoperiod and 26 Eins. m^{-2}, s^{-1} light intensity allow plantlets to harden. When tested at -9°C, Sonja 31 hardened already after 1-2 weeks, whereas Huia #5 required 3-4 weeks exposure. The finding suggests that the preconditioning of the plants prior to freezing has to be adjusted not only for the species but also for the individual genotypes.

Since the pre-treatment of plant tissues for freeze-drying is identical as for the cryopreservation, responses to the conditioning and the rate of freezing

were tested following cryopreservation protocol. Cell cultures obtained from the best callusing genotypes of pototo, a selected clone of Solanum cardiophyllum and a clone C14-343 of Solanum tuberosum were used in this study. Medium of Collins et al. (Crop Science, 1978, 18:286-288) was used for callusing and maintenance of cell suspension culture. The following protocol was used for the conditioning and freezing. Four day old cell cultures were cooled in cryotubes to 0°C. Proline and DMSO were then added over 1 hr periods to the final concentration, 0.87 and 0.51 M respectively. Ice crystals were added into each ampule and the samples were kept for an additional hour in the ice bath. Uniform plasmolysis was observed under the microscope.

The cells were then frozen at a level of 1.5 in a Handi-Freezer (Taylor-Wharton) tray and placed into a 3 SVHC Cryogenic Refrigerator (Taylor-Wharton) containing 10 1 of liquid nitrogen. Slow freezing, -0.5 to -2°C/min up to -35°C was achieved using this method. The cells were then immersed in liquid nitrogen. Samples were taken for the viability test before and after the liquid nitrogen storage.

There was no viable cells after storage in liquid nitrogen. The technique of freezing cells below 0°C seems to be, however, promising and will be utilized in freeze-drying experiments. Refrigerated shelf dryer, an attachment to the freeze-dryer, which has just arrived (first one arrived in June 1987 but was broken) has a precise temperature control option. We will attempt freeze-drying experiments in the range of -10 to -35°C, using shoot tips, axillary buds and cell suspension cultures.

TITLE: Effects of Fertilizers and Soil Properties on Asparagus Yield and Nutrition

LEADER: P.R. Warman

OBJECTIVES:

1. To determine asparagus response to different rates and sources of fertilizer.

2. To compare the yield of spears and the growth and elemental composition of asparagus ferns grown in two soils of contrasting chemical and physical properties.

PROGRESS:

Experiments were initiated in 1985 at 3 locations in Nova Scotia. The Lismore site was abandoned in May, 1987, due to extensive wildlife damage leaving plots Princeport and Beaver Brook. 1987 spear yields represented the second complete harvest; yields at Princeport averaged 14 times greater than in 1986, yields at Beaver Brook averaged 3.6 times as great as the previous year.

Fertility amendments at Beaver Brook included the recommended soil test rate of N-P_2O_5-K_2O, 1/2 the P_2O_5 rate + N-K_2O, 2 rates of Mg + N-P_2O_5-K_2O, 2 rates of B + N-P_2O_5-K_2O, beef manure and composted beef manure. Manure and compost applications were based on total Kjeldahl N analysis of manure and the N level recommended. Treatments did not influence spear yields significantly, although the Mg applications, as epsom salts, produced the highest yields (as in 1986). Fern tissue Mn and B were the only elements of the 10 analysed which showed treatment effects; the Mg treatments influenced tissue Mn and the high B treatment produced the highest tissue B.

The plots at Princeport compared the effect of legumes intercropped between asparagus with clean tilled (control) asparagus. All plants received soil test recommended levels of lime and fertilizer. Control plots produced the most spears; the remaining intercropped plots produced the lowest yields. Fern tissue N, Mg, Cu, and B were influenced by previous legume intercrops.

The soil samples taken at the same time as the fern tissue are being analysed and statistically evaluated. One more harvest is planned for May, 1988 to provide an estimate of the response to the 1987 fertilization.

Project 87-75

TITLE: Direct, rapid assay for tritiated water (^{3}HOH) in soil samples.

LEADER: J. C.. Miller

OBJECTIVE: The use of tritiated water (^{3}HOH) as a tracer is an important technique in studies of water movement and solute transport in soil. Modern liquid scintillation counters allow for rapid and convenient assays of tritium. However, the standard method of preparation of soil samples for radioassay of tritiated water involves the separation of water from soil by either centrifugation or distillation.

A substantial saving in time and labour can be achieved if the moist soil sample could be mixed directly with the scintillation cocktail for liquid scintillation counting (LSC) of tritium activity. It is the objective of this project to develop and test a system for counting and quench correction in ^{3}HOH--soil--scintillation cocktail mixtures.

PROGRESS:

The liquid scintillation cocktail formulation developed in our experiments were suitable for the purpose described in the objectives. It was determined that very careful control oer either the amount of water or the amount of soil in the samples was required in order to use standard correction curves to convert the intensity of radiation detected by the LSC to actual intensity of radiation emitted by the sample.

Five recently developed commercial non-gelling L. S. cocktails with enhanced water miscibility were tested against the cocktail formulated in our lab. Our dioxane-based cocktail exhibited greater counting efficiency over the range of conditions studied and required shorter settling time to reach a stable count rate than any of the commercial cocktails tested. The commercial cocktails were, however, safer to use than the dioxane-based cocktail. Three of the commercial cocktails appeared to satisfy the criteria set for direct counting of tritiated soil samples.

Project 87-77

TITLE: Improved cage design for laying hens

LEADER: T. Tennessen

OBJECTIVE: To study the effects of artificial dawn and dusk on behaviour of hens housed in colony cages.

PROGRESS:

This study is not yet completed. Synopsis to date: Light control created an artificial "dawn" and "dusk" by turning on and off gradually over a 30 minute period. The hens quickly learned the significance of "dusk" and tended to move to the upper level. At that time there was considerable competition for perches and nest-boxes. Egg-laying performance was compared to a group of 120 similar hens; kept in single-bird battery cages. Over a 100 day test period, hen-day production was 0.865 in the single-bird cages and 0.841 in the colony cages. 89.7% of eggs were laid in the nest-boxes. Colony housing of laying hens in modified battery cages has the potential to be an acceptable management tool. Further research aimed at increasing stocking density is warranted.

Project 87-83

TITLE: Prediction of Carcass Fat In Broiler Chicken

LEADER: D. L. Patterson

OJBECTIVES:

1. To complete the chemical analysis of percent carcass fat in male and female broiler chickens of two strains.

2. To establish the value of plasma VLDL measurements in predicting percent carcass fat of broiler chickens.

PROGRESS: Three hundred and twenty chickens, a sample of a flock of 1000 birds, were raised under typical commercial broiler management. The birds were of two genetic stocks, a commercial broiler strain (Arbor Acres x Arbor Acres) and a purebred White Rock stock. Body weights and measurements were taken at weekly intervals, and twenty males and twenty females from each strain were slaughtered at each of four weekly intervals from four weeks to seven weeks. Prior to slaughter a blood sample was collected from the brachial vein for analysis of plasma VLDL.

At seven weeks of age, males of the commercial strain averaged 1883g live weight while those of the White Rock strain were 717g. Abdominal fat as a percentage of live weights was 2% in the commercial strain at four weeks of age and increased to 2.8% for males and 3.3% for females at seven weeks. The values for White rocks were less than 1% at four weeks and 1.9% at seven weeks. Deposition of fat is related to the stage of the growth curve.

Across all age-sex-strain groups, the phenotypic correlation between blood VLDL level and abdominal fat as a percent of carcass weight was 0.43. However the correlations on a within age-sex-strain group varied from -0.21 to +0.67, indicating that blood VLDL level is not a very accurate indicator of abdominal fat percent on an individual bird basis.

Project 87-84

TITLE: Wet versus dry feeds for foxes (lactation supplements and weaning diets.

LEADER: D. M. Anderson

OBJECTIVES: To investigate the use of lactational supplements for nursing puppies and to determine the creep feed consumption of puppies from birth to weaning (5 weeks).

To construct and evaluate a creep feeding device that will effectively exclude the vixen from consuming creep feed.

To develop suitable diets based on wet or dry ingredients for foxes from weaning 5 weeks to 10 weeks of age.

PROGRESS:

While supplemental feeding of vixens was done after the pups were 21 days of age the growth of the litter to 21 days depended on milk production by the vixen. Litter size was not an important consideration since litters were standardized (4-5 pups) among the vixens on this test. The numbers of vixens included in this test was 30 (Table 1). Weight loss by the vixen up to 3 weeks post whelping appears related inversely to the feed consumed during the same period. An average of 92 to 184g/vixen were lost during the first 3 weeks after whelping. Weight loss by the vixen was not indicative of a greater milk yield if gain from birth to 3 weeks is used as a measurement. Since the vixen would most often consume the creep feed in competition with the puppies total feed consumption reported includes both figures. The creep feed is designed to be heavily supplemented to replace vixen's milk. Unless the puppies can be provided with preferential access to the creep feed, there appears to be little economic merit in providing creep feed to the puppies. Further studies in this area are designed to develop a creep area providing access only to the puppies to determine their consumption of creep diet.

Post weaning performance compared a commercial diet commonly used in the postweaning period with diets based on dry or wet feedstuffs. The feed consumption on dry based feeds was higher than when wet ingredients were used, while the growth rate was not improved (Table 2).

Feed efficiency was best on the wet ingredient feed FFW1 at 1.65 compared to 2.51 and 3.04 for the other diets. The data indicates an important growth advantage when fox puppies were provided with wet feed ingredients.

Further studies on diets suitable for this period of growth will be tested in this years work. A total of 100 fox puppies will be evaluated over this time frame using diets similar to those used in the present evaluation.

Due to lack of animals retained for breeding the gestation phase of this work could not be completed.

TABLE 1 Weight changes of vixens and litters during a 42 day lactation period

	Control	Commercial	Commercial + Liver
Number of vixens	7	10	13
Feed consumption (kg)			
0 - 21 days	4.60	3.82	3.94
21-42 days	8.26	7.23	7.25
Total	12.87	11.05	11.21
Litter wt. gain (g)			
0-21 days	1799	1272	1554
21-42 days	3559	3044	3404
Vixen wt. change (g)			
0-21 days	-92	-160	-184
21-24 days	293	165	39
Creep feed/pup	1019	1666	894

TABLE 2 Post weaning performance of fox puppies provided with commercial or home mixed diet from weaning to 10 weeks of age.

	Commercial	FFW2 Home mixed dry ingredients	FFW1 Home mixed wet ingredients
Feed consumption* (kg)	3.12	2.94	2.05
gain in weight (g)	1026	1172	1246
feed/gain	3.04	2.51	1.65
number of	42	39	43

*Feed consumption is determined on 100% dry matter basis

TITLE: Effects of cover crops on subsequent sweet corn growth and soil properties

LEADER: P.R. Warman

OBJECTIVES:

1. The project was undertaken to determine the effects of 4 cover crops on the yield of a subsequent sweet corn crop, its elemental composition, and soil fertility.

2. A growth room study was set up to determine the amount of N_2 fixation and uptake by legumes compared with ryegrass grown under conditions similar to the field study. The effect of Mo and Co amendments on growth and N_2-fixation was also determined.

PROGRESS:

Green manure crops have been used to improve soil fertility and increase soil organic matter; as cover crops they protect the soil from erosive forces of wind and water. Soils under row crop cultivation, such as corn, are particularly sensitive to erosion.

The project was initiated in the fall of 1986 when cover crops (annual ryegrass, kale, Austrian winter pea and vetch) were planted after a sweet corn harvest. Prior to winter freeze up, biomass samples were taken of the cover crops to determine the quantities of the nutrients that would be incorporated into the soil in the spring. The following spring (1987), it was found that the use of cover crops after the harvest of sweet corn was an effective means of reducing soil erosion. The incorporation of the cover crops into the soil was the only nutrient source for the succeeding sweet corn crop. The cover crops did not significantly increase the corn yields or change the elemental tissue composition when compared to the control plots. Soil nutrient levels were relatively high for all cover crop treatments; however, the plots with unfertilized ryegrass were significantly lower in P_2O_5, K_2O and Ca.

A parallel study was conducted in the growth room to determine the effects of the micronutrients, Mo and Co, on nitrogen fixation and on total dry matter yield. The crops chosen for the study were sweet clover, red clover, Austrian winter pea, Tangier pea and annual ryegrass (control). The crop response to the micronutrient amendments was measured at 5 weeks and 10 weeks. The nitrogen fixation capacity of the crops was determined using an acetylene reduction assay. The amount of acetylene reduced to ethylene at the 6 week sampling date was 3-7 times that at the 10 week sampling date. At both samplings, the largest amount of ethylene produced was by the red clover, followed by Austrian winter pea, sweet clover, Tangier pea and ryegrass. The ethylene produced by the ryegrass roots represented free living N-fixing bacteria that would be common in the root rhizosphere. There was no significant increase in dry matter yield due to the micronutri-

ent amendments. The yield was higher for all crops at the 10 week sampling date and at each sampling date the Tangier pea produced the largest amount of dry matter per plant, followed by Austrian winter pea, sweet clover, red clover and ryegrass.

TITLE: Growth and Yield Component Study of Two and Three Year Cycle in Lowbush Blueberry

LEADER: H.-Y. Ju

OBJECTIVE: To study the growth and yield of lowbush blueberry crops of two and three year cycle systems

PROGRESS: The two and three year cycles of blueberry management were studied at three locations in Nova Scotia, each with a first and second year fruiting field. Two locations in the Southampton area (Thunderhill and Westbrook) were provided by Mr. David Dickinson. The third location was Pigeon Hill (Williamsdale) provided by the Bragg Lumber Co..

In each field, quadrat samples were taken in May and August. In all locations fifty random samples were also taken. The May samples provided preliminary data on plant density and flower bud number. The August samples supplied yield data and further data on plant number and age.

No significant difference was noted in berry fresh weight between first and second fruiting year fields, although a trend indicated the first fruiting year fields to have a somewhat higher yield. Total plant length was also not significantly different, but the trend indicated that second year plants were longer. Nor were there any significant differences in the number of berries per plant in first and second fruiting year fields. Weeds are a major problem in a second fruiting year field and has been cited as one possible reason for reduced yields in the second fruiting year.

The two year cycle of management is the choice of most growers as it produces higher yields but at an increased cost of production. In the three year cycle second fruiting year yields are reduced but the cost of production is much lower. This advantage should be considered, but more study is required before a recommendation can be made.

Project 87-89

TITLE: In vitro tuberization as an indicator of heat stress tolerance in potato

LEADER: J. Nowak

OBJECTIVE: To test possibility of application of *in vitro* tuberization technique in clonal selection of potato for heat stress tolerance.

To compare the results of this selection with heat response of potted plants.

PROGRESS:

Canada is one of the major exporters of seed potato to countries with warmer climates. Commercial cultivars of potato do not tuberize well under tropical and subtropical conditions. There are, however, reports which indicate that recurrent clonal selection might overcome this problem. Such selection done in field experiments is time-consuming and labour-intensive. In searching for a simple screening method of evaluation of heat stress tolerance, tuberization ability was tested *in vitro* at 20° and 28-30°C. Four potato cultivars were used: heat stress tolerant Desiree and clone LT-2, and heat stress sensitive Kennebec and Russet Burbank. Mother plantlets were grown under long day conditions (Sipos, J., J. Nowak and G. Hicks, 1988, Am. Potato J., in press) for six weeks before the nodal cuttings were taken for the tuberization study. Two experiments were performed using two different gelling agents, agar (Machado, S.V. and J. Shupe, 1985, Beltsville Symp. on Tissue Culture as a Plant Prod. System for Hort rops, Abs. 17) and gelrite (Bourque, J.E., J.C. Miller and W.D. Park, 1987, In Vitro Cellular & Develop. Biol. 23:381-386). Both experiments were performed in GA-7 magenta vessels in the dark. Media conditions for tuberization were as described in the papers cited above.

Tuberization was recorded in all four cultivars, on both media protocols at 20°C. Under heat stress conditions (28 or 30°C) Russet Burbank did not produce tubers in either experiment, while LT-2 tuberized in both experiments. The results are consistent with field response of these cultivars observed by other authors. It was observed, however, that while Desiree did not tuberize on the protocol with agar and tuberized well on the medium with gelrite. Tuberization of Kennebec likewise was poor on agar but considerable on gelrite containing medium.

Thus, there is potential for the application of this method in cultivar evaluation for heat stress tolerance. More tuberization protocols, however, have to be evaluated and a much larger number of clones tested before conclusions can be drawn.

Supplementary evaluation of the cultivar response to heat stress was performed on the obtained microtubers. Tubers produced at 28 or 30°C had lower dry weight compared to those at 20°C. Quantitative and qualitative difference were also observed on the SDS-polyacrylamide gel electrophoregrams (SDS-PAGE) of protein extracted from tubers of the same size, produced at 20 and 28-30°C. The differences were most pronounced in heat susceptible Kennebec, less in Desiree and least in the heat resistant clone LT-2. A protein band of molecular mass approximately 22,000 is of particular interest. It was strongly pronounced in the tubers produced at 20°C and absent in the tubers from 28-30°C.

These experiments demonstrate potential for the application of <u>in vitro</u> tuberization combined with SDS-PAGE electrophoresis in screening for heat stress tolerant clones in potato breeding programmes.

Project 87-90

Title: Thiocyanate-Crucifers

Leaders: T.H. Haliburton, Hak-Yoon Ju

Objective: To study the effects of growth regulators on thiocyanate content and myrosinase activity in Chinese cabbage and Japanese winter radish.

Progress:

The effect of gibberellic acid (GA_3) and mepiquat chloride, a GA inhibitor, on cruciferous plant thiocyanate (SCN^-) content and myrosinase isozyme activity was studied. In a preliminary greenhouse study GA and mepiquat chloride concentrations of 0, 10, 100, and 1000 mg/litre produced no significant effect on shoot or root SCN^- content. GA treatments did not produce significant differences in enzyme activity, although 100 mg/litre mepiquat chloride resulted in substantially higher activity levels. The root SCN^- content and enzyme activity of field grown Japanese winter radish were significantly decreased by application of 1000 mg/litre GA. Mepiquat chloride at 1000 mg/litre significantly increased shoot SCN^- content and enzyme activity and decreased root SCN^- content. No significant interaction between GA and mepiquat chloride was observed during the study. The Chinese cabbage trial was not harvested or analyzed due to its premature bolting.

The results of this report indicate that the thiocyanate and myrosinase activity of cruciferous plants may be influenced by plant growth regulator applications. Further investigation is recommended.

Project 87-91

TITLE: Rearing techniques for silver foxes.

LEADER: T. Tennessen

OBJECTIVE: To produce a more easily handled and less nervous adult fox by spending time handling the fox pup during its early critical period of socialization.

PROGRESS: The open-field test, where an animal is placed in an open space and its behaviour recorded, is often used as a measure of fearfulness. Handled foxes showed greater general confidence (Table 1).

	Handled	Not Handled
Time before moving (sec)	12.7 ± 5.4	25.5 ± 7.2
No. squares entered (distance walked)	237.9 ± 14.1	183.1 ± 15.7
	$P < 0.05$	

Further comparisons of behaviour during mating and whelping seasons will be made.

Project 87-92

TITLE: Local high protein feedstuffs for monogastric animals.

LEADER: D. M. Anderson

OBJECTIVE: To investigate the nutritional value of poultry by-product meal samples by use of invitro pepsin digestion and pilot animal digestion trials.

Evaluation of the protein quality of poultry by-product meal samples using PER evaluation with rats.

PROGRESS: No progress report is available at this time.

Project 87-93

TITLE: Price determination in Maritime slaughter cattle market.

LEADER: K. Gary Grant

OBJECTIVE: To explain price determination in the market for cattle produced and sold for slaughter in the Maritimes.

PROGRESS:

Data have been collected and compiled for computer use. These include weekly prices for bulls and various grades of slaughter steers, heifers, and cows at the Toronto stockyards from January, 1976 to June, 1987. There are comparable prices for slaughter cattle auctioned at the Maritime Cattle Market at Truro for March, 1978 to June, 1987. At the wholesale market level, the data include weekly prices for steer, cow and heifer carcasses in the Maritimes from January, 1980 to June 1987, as well as by-product prices for Eastern Canada from January, 1982 to June, 1987.

The data are being analyzed to determine the relationship between current weekly changes in Truro slaughter cattle prices and past changes in Truro prices, as well as current and past changes in Toronto cattle prices.

Project 87-94

TITLE: Translocation of Fungicides

LEADER: J. Hoyle

OBJECTIVE: To investigate the behavior of fungicides used as seed treatments in peas, beans and corn and to develop a new method for the analysis of the fungicides thiram and captan from plant sources.

PROGRESS: Several varieties of peas, beans and corn were grown in field plots and samples of soil and plant material were taken during the growing season. Due to the dry weather some trials were not successful due to the unavailability of plant samples.

Analysis of the harvested produce showed no evidence of fungicides or their decomposition products. However, samples of young plants showed evidence of both captan and thiram which may be a significant factor in the translocation of these compounds into the animal population. Many seeds and young seedlings are eaten by birds and other animals. Soil samples showed evidence of fungicide residues for about a month after planting and also showed that the residue concentration decreases with distance away from the seeds in the soil. There was some evidence of decomposition products of these compounds in the soil for longer periods after planting.

Project 87-95

TITLE: Weed control in blueberries

LEADER: M. G. Sampson

OBJECTIVE: To evaluate the sulfonyl urea herbidies including Oust , Glean , Ally , and Harmony , in both spring and fall applications for control of hexasinone-tolerant weeds, especially bunchberry, which is the most serious weed problem in blueberries.

To evaluate various timings of fall applications of 2,4-D/Dicamba to identify the best time to apply these herbicides with the least amount of crop damage and most effective weed control.

To evaluate post-emergent applications of several herbicides to which blueberries have shown tolerance in previous studies.

PROGRESS:

In 1987, final data recordings were taken on trials established in 1986. These trials were located in North River, Benvie Hill, Mt. Thom and Debert. In these trials, sufometuron methyl (Oust) and chlorsulfuron (Glean) were the most promising compoundns. Applications of 2,4-D/dicamba in early October appears to be the best time for this application. A spring application trial was established in Five Islands, N. S. Chlorsullfuron and sulfometuron methyl performed the best. Trials were also established near Great Village against spreading dogbane and in North River against bunchberry to compare spring and fall applications of various herbicides for control of these weeds. Spring applications will be applied in May, 1988.

FUTURE PLAN:

Final data recordings will be recorded at trials in Mt. Thom, North River and Five Islands. Spring applications will be applied to trials established in May to evaluate the sulfonyl urea herbicides for control of bunchberry. Herbicides to be included in this trial are sulfometuron methyl, chlorsulfuron, metsulfuron methyl, DPX M6316, DPX L5700, DPX R9674 and hexazinone. Each of the fulfonyl urea herbicides will be tested at three rates.

A post-emergent trial will be established in the early summer of 1988 to evaluate herbicides which have demonstrated low phytotoxicity to blueberries in previous trials. Herbicides to be included in this trial are norflurezon, clopyrolid, oxyglurofen, oxadiazinon, and aminotriazol.

A trial will be established in the fall of 1988 to evaluate fall application of 2,4D, dicamba and 2,4-D/dicamba tank

mixed. Five application timings will be applied to identify the best time to apply these herbicides to get maximum bunchberry control but a minimum amount of blueberry phytotoxicity. This trial is a repetition of a trial set up in 1986, but could not be set up in 1987 due to insufficient research funds.

Project 87-96

TITLE: Somato embryogenesis in red clover

LEADER: Jerzy Nowak

OBJECTIVE: To continue study of cell suspension culture and to investigate the potential of artificial seed production.

To continue evaluations of F329 and F464 petiole calli for regenerative ability.

To continue investigations of somaclonal variation.

To determine the heritability of the regeneration trait.

To evaluate any possible correlation between winter hardiness and the ability of a genotype to regenerate from culture.

PROGRESS:

Recent in vitro screening carried out at the Plant Science Department Tissue Culture Research Laboratory, N.S.A.C. has resulted in selection of three regenerative red clover genotypes (cv. Florex) from an initial population of 883 in vitro seedlings. During the past year, a study on somatic embryogenesis of the regenerative genotypes (designated as F49, F329 and F464) was initiated. Progress, to date, is outlined below.

Cell suspension cultures were initiated from regenerating callus cultures of clone F49. Suspensions were subcultured at variable intervals, and were plated on agar media in petri dishes at different ages. Suspensions were plated on callus initiation, embryo induction and plantlet development media. Somatic embryogenesis occurred directly on the plantlet development medium (SPL) while callus growth occurred on the callus initiation medium (L2). Ability of suspension cultures to undergo somatic embryogenesis did not appear to decrease with increasing age of the cultures (2 weeks versus 3 months). Microscopic observations of suspensions revealed that the cultures were largely comprised of single cells, although some cell aggregates were also present.

Petiole sections of epicotyl-derived and callus-derived plantlets of the 3 regenerative Florex clones were callused on B5C medium. To date, only previously regenerated (callus-derived) plantlets of clone F49 have successfully regenerated plantlets from petiole callus. Surprisingly, callus tissue initiated from F49 epicotyl-derived tissue failed to regenerate plantlets. The regenerative ability of the F49 regenerants versus the lack of further regeneration from the epicotyl-derived F49 plant material indicates that a change (possibly genetic) occurred in the initial callus culture. This regenerative and non-regenerative material, originating from the same seedling, offers a perhaps unique model for studying the biochemistry responsible for regeneration from "non-differentiated" tissues. Polyacrylamide gel electrophoresis of F49 donor versus regenerated plantlets showed a quantitative difference in one of the bands (slightly more than m.w. 97,400). Further study is needed to explore this difference.

Six different media sequence combinations were evaluated for efficiency of plantlet regeneration from petiole callus tissue. The optimum combination was found to be L2 callus initiation medium followed by two 4-week passages on SPL medium. Previously recommended protocols for regeneration from red clover callus were comprised of three successive culture passages. With clone F49, however, plantlet regeneration is obvious during a two-step protocol when callus is initiated on L2 then transferred to SPL.

Regenerated and epicotyl-derived plantlets of F49 and F329 have been acclimatized to greenhouse conditions. Acclimatization of F464 is planned in the near future. F49 regenerants in the greenhouse are presently being evaluated for chromosome number, pollen viability and leaf morphology. Chromosome counts have so far all yielded the normal diploid complement (2n=14). Percent pollen viability values (as determined by staining with acetocarmine:glycerol), however, vary markedly from plant to plant within this clone. Meiotic pairing analyses may be warranted in plants with very low pollen viability estimates. Variations in leaf morphology are also apparent within this clone.

Forty-six F49 regenerants were planted in a field plot during the summer of 1987, along with 40 check Florex seedlings and 23 formerly in vitro Florex plantlets which had proven to be non-regenerative. The F49 regenerants flowered at a later date than the other Florex plants, when they flowered at all. Variation in leaf morphology among the F49 regenerants was also observed in the field. A second field planting is planned for the summer of 1988 and will include regenerated and epicotyl-derived plantlets from all three selected clones as well as check plants.

Seed has been collected from hand crosses of greenhouse plants and from natural pollination of field plants. Crossing of greenhouse plants continues. Progeny will be evaluated for regenerative capacity of hypocotyl calli. Such information will be used to determine the heritability of the regeneration trait.

Field trial observations during the spring of 1988 and during the following two years will be used to determine any possible correlation between winter hardiness and the ability of a genotype to regenerate from callus culture. In vitro freezing trials are also planned and will follow the procedures developed in this laboratory for alfalfa and white clover.

Project 87-97

TITLE: Selenium content of sheep blood.

LEADER: K. S. MacLean and A. R. Robinson

OBJECTIVE: To continue to collect sheep blood samples during the winter and early spring months for selenium analysis during the summer.

To complete the evaluation of the selenium status of Nova Scotia sheep.

To analyse all the blood samples collected from this project for copper.

To examine the relationship between selenium and copper levels.

PROGRESS:

Initial work on this project involved obtaining a large composite blood sample and determining the precision of analysis and the percent recovery of selenium added to the blood.

The results reported in Table 1 show that excellent precision and percent recoveries were obtained using the atomic absorption hydride generation method.

Table 1

Precision and % Recoveries of Selenium Analysis in Whole Blood

Trial #	% Se Recovery	
	Technician 1	Technician 2
1	99.9% (95.9 - 105.1)	101.3% (97.1 - 105.8)
2	100.0% 87.3 - 118.4	100.3% 96.8 - 102.5
3	99.9% (83.4 - 107.8)	101.2% (98.3 - 106.7)

The overall percent recovery was 100.4%. The better precision obtained by Technician 2 may be attributed to the use of the new automated continuous flow hydride generator.

Australian sheep blood samples used in an international study of selenium analysis methods and obtained through the courtesy of Dr. Gilles Bleu at the Hospital Maisonneuve-Rosemont, Montreal, was also analysed. These results reported in Table 2 indicate that our values are within the range of selenium values found by eleven different laboratories using the hydride method. The same composite samples were analysed by all laboratories.

Proposed Project Continuation

1. Samples of sheep blood will be collected (Feb. - April) from the same flocks sampled this summer to evaluate selenium levels in animals receiving selenium supplements under winter feeding and housing conditions.

2. It is also proposed to continue sampling and analysing Nova Scotia flocks this coming spring and summer.

3. It is planned that the blood samples already collected and those to be collected will be analysed for copper.

   Nova Scotia is known to be low in copper and problems from this source are known to exist within the province. It is hoped that the samples from this survey will define the extent of the problem.

4. The possibility of a Se-Cu interaction has been suggested by Chen et al (1985) and Chmielnicka et al. (1985). It is proposed to examine this relationship.

Table 2

Selenium Content of Internationally Analysed Whole Blood Samples

Sample No.	Se (ppm) Average, range, Std deviations	
	N.S.A.C.	International Value
1	0.090 ± 0.006	0.084 (0.070 - 0.102)
2	0.014 ± 0.001	0.012 (0.008 - 0.020)
3	1.30 ± 0.07	1.17 (1.00 - 1.35)

Sheep Blood Analysis

During the summer of 1987 a total of 161 blood samples were collected and analysed for selenium. These samples represented 10 flocks from throughout the province. The range of values according to location is given in Table 3.

Table 3

Selenium Levels in Whole Blood of Nova Scotia Sheep

Location	Selenium Ranges (ppm)
N.S.A.C.	0.068 - 0.282
Debert	0.116 - 0.273
Bridgetown	0.100 - 0.239
Upper South River	0.036 - 0.153
Port Hillford	0.070 - 0.230
North River	0.133 - 0.206
Pubnico	0.032 - 0.108
Scotch Village	0.026 - 0.342
Noel	0.032 - 0.053
Wallace	0.014 - 0.100

Langlands et al. report that if whole blood selenium levels in sheep drop to 0.025 ppm or less that deficiency symptoms will become evident. It is only natural to predict that hidden deficiencies will occur at levels above this limit which will adversely affect the health of sheep. From the results reported in Table 3, it is evident that some sheep are below the deficiency limit while many others could be in the hidden deficiency range.

Project 87-98

TITLE: Propagation and screening of non-traditional sources of stress tolerance in *Solanum* species

LEADER: Dr. David Midmore

OBJECTIVE: To provide technical assistance to maintain *ca.* 55 *in vitro* clones of *Solanum tuberosum* and wild species as well as true seed propagated wild species.

To screen for heat tolerance (high dry matter production, high photosynthesis and low respiration) and shade tolerance in *Solanum tuberosum* L. and wild *Solanum* species.

To relate leaf anatomy to rates of photosynthesis in order to devise a short-cut screening technique.

PROGRESS:

All cultivated clones, primitive cultivars and wild species of *Solanum* received from CIP, Peru, and the IR collection at Sturgeon Bay, have been successfully cultured in the *in vitro* condition (a number of accessions were received as botanical seed or seed tubers) and are under multiplication according to the accompanying schedule (Table 1) in order to provide sufficient plants of each accession for the first IRGA evaluation of respiration and photosynthesis (R & P) under high temperature conditions.

RESEARCH PROCEDURE

On 19/02/88 the first group of clones was placed in the growth chamber (30/20°C day/night) and on 29/02/88 the first measures of R & P will be made (on cool-produced leaves) and the second set of R & P measures for those clones will be made on 21/03/88 (on hot-produced leaves). A cyclic series of evaluations will be made, with the second group entering the chamber two weeks after the first, and R & P measures to be made on 14/03/88 and 04/04/88. Final R & P measures of the final group will be completed during the week 13-17/06/88. At the same time as quantification of R & P is made, leaf samples will be fixed in FAA and mounts, later made to quantify the following characters known to be closely related to photosynthetic temperature adaptation (Patterson, 1980):

Stomatal density
Mesophyll cell size and thickness
Chloroplast distribution and density

Concurrent with the R & P measures, growth rates will be measured, using classical growth analysis procedures, in order to partition dark respiration into maintenance and growth components (McCree, 1982) with the object of identifying clones with low maintenance rates, as has been achieved with ryegrass (Wilson and Jones, 1982).

Finally, with clones characterized by high rates of photosynthesis, and/or low rates of dark respiration, photosynthetic light response curves will be quantified in order to determine whether genetic variability exists for photosynthetic rates under low irradiance, an important feature if clones are to be selected for their ability to perform well under tropical environments with high temperature and low light intensity, and when intercropped.

Project 87-99

TITLE: Managemennt of Spring Canola

LEADER: C. D. Caldwell

OBJECTIVE:

1) To assess the efficacy of Rovral and Benylate, alone and in combination, for control of stem rot of two spring canola cultivars.

2) To assess the efficacy of HOE 39866 and glyphosate, in comparison to diquat, for dessication of spring canola for harvest purposes.

PROGRESS:

1) Rovral and Benylate were compared for efficacy at an early growth stage (G.S. 3.1) and a late one (G.S. 4.1) and also in sequential combinations. These experiments were performed on Global and Westar, both Argentine types of canola. Westar is, in general, more susceptible to stem rot than is Global. The disease incidence data show that disease is reduced most by a late (G.S. 4.1) application; Benylate may be marginally more effective than is Rovral. Field trials in both 1986 and 1987 had very low levels of natural infection so it is difficult to form firm conclusions on efficacy.

2) HOE 39866, an experimental dessicant from Hoechst, was tested at three rates, with and without Agral 90 as a surfactant. Diquat (Reglone) was used as a dessicant check. Glyphosate (Round-up) was also tested at three rates with the surfactant Agral 90. Both HOE 39866 and glyphosate act as slower dessicants than diquat. This gentle dessication, especially that of HOE 39866, produces excellent dry-down with much less incidence of shattering loss both before and during harvest. There appeared to be no benefit in having the surfactant Agral 90 as part of the HOE 39866 spray.

The efficacy data produced in these experiments has formed part of the data package used in support of the licensing of HOE 39866 for commercial use. It should be available to farmers in 1989 under the trade name IGNITE.

Project 87-101

TITLE: Dietary pre-lay calcium and layer performance

LEADER: D. C. Crober

OBJECTIVE: To compare the effects of supplementing pullet grower ration with oyster shell during the immediate pre-lay period, with respect to laying house performance of egg production stock; to examine the interrelationship between pre-lay calcium supplementation and differences in stock genotype and laying period housing format.

PROGRESS:

This project was conducted to examine the influence of different stocking densities and population sizes on the performance of a range of genetic stocks of caged Leghorn layers. (A parallel study {87-67} examined the extent to which any such effects could be attributed to differences in blood corticosterone level.)

Two flocks of approximately 1900 birds each were used. In the first, three experimental strain crosses were represented. In the second, there were again three experimental strain crosses, two of which were the same as those of the first flock, and one commercial stock. All experimental birds were obtained from the Animal Research Centre, Ottawa while the commercial birds were purchased locally. For both flocks, equal proportions of each genotype were housed over a 12-month laying period in three different sized cages at two stocking densities, i. e. 1 bird per 20 cm (8") cage (frontage) and 2 birds per 20 cm cage; 3 birds per 31 cm (12") cage and 4 birds per 31 cm cage. All cages were 41 cm (16") deep. Mortality and hen-housed egg production of both flocks was consistently superior at the lower stocking density for all cage sizes. Also, at both densities, performance improved with increasing cage size. These trends were more apparent for egg production than for mortality. Significant differences in egg production between stocks were observed for both flocks. Such differences did not exist with respect to mortality. There was also a significant interaction between stock and stocking density, particularly with the first flock, for egg production only.

A. R. C. = Animal Research Centre
Agriculture Canada, Ottawa

Project 87-102

TITLE: Milk Production In Beef Cattle

LEADER: Andre Lirette

OBJECTIVE: Testing of different milking techniques to determine one is the most appropriate for the needs of the experiment: - weigh - suckle - weigh techniques - teat catheter and oxytocin - milking machine/squeeze.

Demostrate the effect of milk production by purebred British cows when bred with an exotic bull versus when they are bred to bulls of their own breed.

Investigate the implications of suckling effect and/or sire effect on the milk production of these cows.

Demonstrate milk conversion rate in crossbred and purebred calves.

PROGRESS:

There are three different techniques which can be used to milk relatively wild beef cows. These three techniques are the following: - weigh-suckle-weigh technique; - portable milking machine technique; - teat catheter associated with injection of oxitocin.

We tested these different milking techniques during the summer 1987 to find out which one was the most accurate and the easiest to use in a milking project involving a large number of beef cows. It appeared that the weigh - suckle - weigh technique was not accurate mainly because some calves were urinating and defecating between the two weighing periods and consequently had their original weight significantly modified. The technique using a portable milking machine was relatively accurate and most of the cows were staying surprisingly calm. However, some resisted decreasing their milk release. The last technique or the teat catheter technique with injection of oxytocin was the easiest and appeared to be the most accurate and the fastest. An antibiotic cream applied on the catheters needed to be used to prevent mastitis. It was concluded that this last method was the most appropriate to milk a large number of beef cows relatively accurately.

A second step will serve to effectively measure the milk production of Shorthorn cows bred with Shorthorn bull compared with Shorthorn cows bred with a simmental bull. Milk production and composition will be analysed, rate of growth of the calves will be evaluated. Milk conversion will be calculated and milking

curves will be traced. Blood concentrations of estrogen and progesterone will be measured to see if a bigger fetus and so placenta would increase the production of these hormones and consequently produce a larger cow udder.

Project 87-103

TITLE: N.M.I. In The Study Of Forage Structure

LEADER: Andre Lirette

OBJECTIVE: Investigate the possibility of using Nuclear Magnetic Imagine (NMI) to get an image of the internal chemical structure of different species of forages and maturity levels.

Investigate the possibility to modify the actual H^1 - NMI to a C^{13} - NMI.

PROGRESS:

In cooperation with the Division of Biological Sciences of N.R.C. in Ottawa, experiments were done to evaluate the possibility of using Nuclear Magnetic Resonance Imaging (N.M.I.) with plants and particularly with forage. This approach involves the use of magnetic field gradients to provide anatomical images of intact biological systems. This relatively new n.m.r. method has been termed spin-imaging or "zeugmotography". Preliminary results indicated that relatively good images can be obtained from plants by this approach. Relative quantity of plant water content and inside structures of plants can be seen directly. Evolution of plant pathologies can be followed without destroying the plant. This technique appears to have promise for the fields of Plant Science, Plant Pathology and Animal Science.

The actual H^1 - NMI can be modified in a C^{13} - NMI. However, the resolution of the equipment is not enough for imaging. An high resolution NMI apparatus would be needed. This equipment will be the object of an equipment grant application to N.S.E.R.C.

Project 87-104

TITLE: Digital Image Analysis of Animal Shape

LEADER: D. L. Patterson

OBJECTIVE: To evaluate and develop protocols for a microcomputer based image analysis system to objectively assess body composition of animals.

PROGRESS:

1) A commercial image analysis system including software, a digitizing tablet and a raster graphics board was purchased. The system, the Bioquant System IV ™ (R & M Biometrics Ltd., Nashville, TN), running on an IBM-XT 286, was developed for use in medical and biological laboratories and hence is readily used for evaluating animal shape. The system allows for digitizing from slides, photographs, videotape, or in 'real-time'.

2) A protocol has been developed for taking still photographs of animals. It is important that measurements be easily taken, be repeatable and be relevant to the economically important conformation traits. Including a measure of scale in the same plane as the animal and marking anatomical reference points on the animal allow for taking repeatable measurements off photographs which correlate well with actual body measurements. Digitizing is very quickly done. The area of a simple shape can be determined in less than a minute and fifteen to twenty measurements can be taken off a photo in two to three minutes. A protocol is now being developed for most efficiently using videotapes with the system.

3) The system is currently used for determining area of beef rib-eye muscle tracings, for a study involving prediction of broiler chicken carcass quality from live bird photos and carcass tracings, and for assessment of conformation in dairy cattle. However it can also be used for such things as tracking animal movements and determining counts and areas of microscopic specimens.

This project was supported by the Dean's Grant - Agriculture Canada.

Project 87-105

TITLE: Effect of Breeding System on Reproductive Performance of Broiler Breeders

LEADER: H. N. Jansen

OBJECTIVE: To compare the relative efficiencies of artificial insemination and natural mating in the production of broiler hatching eggs using the Marshall (European) and Arbor Acres (North American) commercial breeder stocks and breed performance.

PROGRESS:

August 6, 1987 representative samples (350 females and 50 males) of each breed (Marshall & Arbor Acre) of day-old chicks were started at N.S.A.C. Marshall Strain was quarantined for 4 weeks in the Kentville area. These birds were feed restricted according to body-weight. Birds were weighed weekly (3-24 weeks of age). Mortality, feed consumption, water consumption and body weights were collected for females and males.

At 19 weeks of age representative samples of each breed were housed on the floor and cages. At 20 weeks the lighting program was initiated.

During the laying period males and females will be fed separately. Male exclusion rings were installed on the female feeders. Male feeders were installed in the floor pens at 20 weeks of age when the males were introduced to the females.

Artificial insemination with the caged breeders was started at 25 weeks of age. These birds are inseminated once weekly.

Egg production commenced at 25 weeks of age.

Eggs are collected daily and sorted for hatching eggs. Floor eggs, if any, are kept separate.

Daily data collection includes, egg production, feed consumption (male and female) hatching eggs, floor eggs, cracks, peewees and double yolks.

Representative samples of each breed and housing environment will be hatched monthly to determine fertility and hatchability. Body weights will be collected every 6 weeks.

The birds are presentatly 28 weeks of age.

This experiment will be finalized October 13, 1988.

Project 87-106

TITLE: Baseline Data on Fox Development

LEADER: T. Tennessen

OBJECTIVE: To accurately record the physical development of silver foxes from birth to pelting.

PROGRESS: 30 silver fox pups were weighed and measured in detail every week to age 16 wks.

Selected Measurements (mean ± SEM)

Age of eye opening (days)		
slits begin to show		15.1 ± 0.64
Eyes completely open		18.8 ± 0.63
Data at age 2 wks:		
weight (g)	F	332.0 + 17.4
	M	316.2 ± 17.1
height (cm)	F	10.3 ± 0.3
	M	9.8 ± 0.5
length (cm)	F	14.5 ± 0.3
	M	14.7 ± 0.3
hair length (mm)		
	F	24.6 ± 1.0
	M	24.6 ± 1.3
Data at age 15 wks:		
weight (g)	F	3633.0 ± 56.6
	M	3951.1 ± 101.4
height (cm)	F	31.0 ± 0.2
	M	31.9 ± 0.3
length (cm)	F	42.2 ± 0.2
	M	42.8 ± 0.6
hair length (mm)		
	F	54.1 ± 1.1
	M	55.1 ± 1.2

Project 87-107

TITLE: Reproductive Performance in Swine

LEADER: M. L Connor

OBJECTIVE: To establish whether a relationship exists between leanness (backfat thickness) and a) puberty onset and b) interval to first postpartum estrus in swine.

PROGRESS:

With the development of fast growing lean pigs has come the concern that leaner gilts are not reaching puberty early enough nor staying long in the breeding herd. Similarly, post lactational anestrus is a major problem in some herds and may be related to depleted body reserves. This may be reflected as low backfat thickness.

Measurements and observations were made on 81 sows and 11 replacement gilts on three separate farms. Backfat, body weight, age at puberty and litter performance were recorded for each gilt. Sow measurements included weight, backfat thickness, litter size and weight at farrowing, weaning and estrus if anestrus was >9 days after weaning.

The small sample size and differences in management practices precluded determining any influence of backfat thickness on age at puberty. As well, post lactational anestrus did not prove to be a problem during this study though wide variation in apparent animal condition was observed. Litter weights between farms were significantly different ($P<.05$) at farrowing and weaning. Though differences in backfat were not significant, the weight of the sow at farrowing was positively correlated with litter weight ($P<.05$) and negatively correlated ($P<.06$) to days anestrus. Results indicated that sow weight directly affected reproductive performance with heavier sows producing heavier litters and returning to estrus sooner than lighter sows regardless of parity. More extensive investigations using more accurate equipment are needed to determine whether backfat thickness can also be implicated with reproductive performance.

Project 87-108

TITLE: Assay for melatonin

LEADER: M. L. Connor

OBJECTIVE: To establish a valid radioimmunoassay for blood melatonin in our laboratories.

To quanitate blood melatonin levels in fox during furring and reproduction. (Completion of 410-061)

PROGRESS:

The objective of this project was to establish a valid melatonin radiommunoassay in our laboratory.

An assay procedure used for human serum was tested. Most of the materials were supplied by a MacMaster University group interested in our application to furbearers. The assay system shows promise but needs some modification and further refinement before it can be validated and used to its fullest in our laboratories.

Two unanticipated developments prevented full completion of this project. One was extended personal involvement in another outside research project (fox blood profiling) which demanded considerable personal time. The other involved the health status of the technical assistant which prevented conducting parts of the assay procedures.

The validation of the melatonin RIA system can be done with renewed financial support. It is also important to completion of project 410-061 and to support continued studies in reproduction, physiology of photoperiod in livestock and of furring cycles.

An extension of this project and permission to carry over $2,000 left in the account and $2,600 left in the 410-061 account to the 1988-89 year are requested.

Progress Report on 410-061 - Melatonin and Reproduction in Furbearers

Sixty fox and 30 mink were implanted with one or two dose levels of a melatonin implant in July.

Implanted animals grew and furred more quickly than controls. The higher dose level of melatonin tended to produce a heavier animal with more dense underfur. These animals reached prime before the lower level implanted animals and controls. The analysis and the pelt results are incomplete at this writing.

Males implanted with melatonin tended to show sexual development sooner. Similarly, females exhibited some sexual development. The breeding season is not finished at this time. However, indications of sexual activity are contrary to popular belief about melatonin's influence on reproduction.

It is important to be able to analyze the blood plasma samples collected. This will provide a glimpse of the internal milieu influencing these animal's physiological responses. Combined with other observations we should have a better understanding of melatonin's role in furring and reproduction in silver fox.

Support of the renewal for 410-036 assay for melatonin is requested.

Project 87-109

TITLE: Canola Meal in Diets for Lactating Sows

LEADER: D. M. Anderson

OBJECTIVE: To evaluate the effects of introduction of canola meal to diets of sows at the time of farrowing.

PROGRESS:

Producer concerns have recently been expressed regarding the use of canola meal in lactation diets for sows. The cause for concern appears to be that when sows have been provided with a gestation diet without canola meal and then are provided with a lactation diet containing canola meal, there is an aggravated reduction in feed intake that results in poorer milking and subsequent reduced performance by piglets from those sows.

Measurement of sow feed consumption, sow body weight change in lactation, piglet growth and mortality were recorded for 23 farrowings where sows received a soybean meal/corn based diet in gestation and then switched to a canola meal/corn based diet at the time of farrowing. The other group (31 farrowings) were provided with a canola meal/corn based diet in gestation and lactation. Sows were weighed prior to farrowing, immediately post farrowing and when the litter was weaned at 3 weeks. Piglets born, born alive, alive at weaning, and weight gain were recorded. Sows were assigned to treatment to balance parities.

All sows were provided with the same amount of feed during gestation 2.1 kg/day. The weight gain by sows fed canola meal/corn were 8.22 kg compared to 4.87 kg for sows fed corn/soybean and (Table 1). As expected, the reduced weight gain in gestation was reflected in a greater weight loss during lactation. Large variation in weight change in sows on both treatments means was noted. Piglets were weaned at 3 weeks of age, the sows on canola meal/corn during gestation consumed 6.32 kg/day during lactation (3 weeks) compared to 5.88 kg/day by sows fed soybean meal/corn during gestation. Although there appears to be a reduction in the feed intake of sows during the first week of lactation (40g/day) by sows not fed canola in gestion this reduction is small.

If palatability of canola meal was a factor in reduced feed intake the amount of feed refusal between groups should have been larger. Performance of the litters of sows preconditioned to canola in the diet was similar to that of sows without canola in the gestation diet. In this trial, the change to lactation feed containing canola meal was done the day of farrowing thereby magnifying the potential effect. There did not appear to be an effect of canola meal addition at the time of farrowing on subsequent piglet performance or the sow's nursing ability.

Table 1. Performance of sows introduced to Canola Meal in lactation diets.

	Units	Gestation Diets: Corn/Canola Meal	Gestation Diets: Corn/Soybean Meal
No. of farrowings		31	23
Sow weight change			
- gestation	(kg)	8.22±7.22	4.87±8.55
- lactation	(kg)	-6.04±13.16	-8.18±9.44
Sow feed consumption			
- farrowing to 1 wk	(kg)	27.1±8.1	24.3±7.4
- farrowing to weaning	(kg)	132.7±26.6	123.5±28.3
Sow feed refusals			
- farrowing to 1 wk	(kg)	0.95±1.29	1.14±1.31
- farrowing to weaning	(kg)	1.53±2.00	1.90±2.78
Piglet number/litter			
- piglets born		1.14±2.2	12.6±2.6
- piglets born alive		10.2±1.6	10.7±1.7
- piglets weaned		9.5±2.4	9.0±1.9
Piglet weight			
- birth weight	(kg)	1.21±.22	1.25±.22
- weaning weight	(kg)	6.14±.89	6.04±.73
- wt gain nursing	(kg)	4.93±.92	4.79±.88

Means ± D Standard Deviation

Project 87-110

TITLE: Water Quality for Pigs

LEADER: D. M. Anderson

OBJECTIVE: To investigate the effects of water high in total dissolved solids (tds) or with modified Ph on the utilization of nutrients by the pig.

To establish effects on the metabolism of pigs when water high in individual salts (sulfates, chlorides) are provided.

PROGRESS:

Swine metabolism cages are in the final stages of preparation for initiation of the digestion trial. Water systems have been put in place to allow delivery of test waters.

At present the experiment has just begun. Pigs will be housed in the metabolism cages within the next two weeks. In this initial study, pigs will not be cannulated but in subsequent trials, the procedure will be done prior to experimentation.

Further progress on the experiment will be forthcoming subsequent to data collection and analysis.

TITLE: The Biology and Control of Coltsfoot (Tussilago farfara L.)

LEADER: Douglas J. Doohan

OBJECTIVE:
1. To develop control practises for Coltsfoot in pre-plant situations, cropping systems and non-agricultural situations.
2. To study the reproductive strategy of Coltsfoot.

PROGRESS: Three weed control and two weed biology studies were established in 1987. Coltsfoot control studies established at Great Village, Colchester County were; Control of Coltsfoot in Barley; Preplant Control of Coltsfoot and Preemergence Control of Coltsfoot. Biology studies included Analysis of Quackgrass Rhizome Reproductive Potential and Determination of Longevity of Coltsfoot Seed Viability.

Coltsfoot Control In Barley

Nine herbicides were tested for selective control of emerging Coltsfoot ramets in emerged spring barley. None of these materials provided satisfactory control of Coltsfoot. These plots will be observed for any residual control in 1988.

Preplant Control of Coltsfoot

Thirteen treatments, consisting of seven herbicides were evaluated for preplant control of Coltsfoot. Each treatment was applied three times during 1987; early July, mid August and late September. Glyphosate was not effective when applied in early July, however, mid August treatments provided excellent control. Rates of 1.0, 2.0 and 4.0 kg/ha glyphosate provided identical control.

Clopyralid at 0.30, 0.60 and 1.20 provided equivocal control with no apparent effect of rate. A tank mixture of 2.0 kg/ha 2,4-D amine plus 1.0 kg/ha dicamba was ineffective when applied in early July but provided 75 percent control when applied in Mid August.

Preemergent Control of Coltsfoot

Eleven treatments were evaluated for preemergence control of Coltsfoot. Herbicides were applied on July 21 to a recently prepared seedbed. Coltsfoot regeneration appeared to be primarily from regenerating rhizomes. Chlorsulfuron was the only herbicide that provided consistent control.

Biology Studies

Studies on the viability of Coltsfoot seed confirmed reports of high viability in freshly harvested seed followed by a rapid decline to zero viability with two months of seed collection.

Studies on the reproductive potential of rhizome material from several Coltsfoot clones was initiated late in 1987 and results are not yet available.

Project 87-112

TITLE: Embryo Survival in Gilts

LEADER: M. L. Connor

OBJECTIVE: To complete the data analysis for a joint project dealing with ovulation rate and embryo survival in gilts.

PROGRESS:

The data from the cooperative project with T. A. VanLunen of Agriculture Canada, Nappan, N. S., was analyzed. The resulting paper is accepted for presentation at the 11th International Congress on Animal Reproduction and Artificial Insemination, Dublin, Ireland in June, 1988.

The abstract covering this material is presented separately in this report (see Ovulation Rate and Embryonic Survival in Gilts).

TITLE: Evaluation of an electronic fertilizer/seed application rate control system

LEADER: John Adsett

OBJECTIVE: To evaluate the performance of an electronic control system (Vicon Model EB820).

PROGRESS:

This system is designed to enable a constant broadcast application rate of fertilizer or seeds to the field, in spite of variations in tractor forward speed.

Field testing with collection trays was carried out on three farms to determine actual application rates over a range of rate settings at various forward speeds. Tests in the field also made observation of lateral spread patterns of various fertilizer components and of different forage seed types.

A tractor forward speed simulator was designed, constructed, and used in the lab to determine the response of the electronic control system to changes in simulated forward speed, and to provide a check on field testing.

The Vicon electronic control system showed good response to simulated forward speed changes in the lab. Measured application rates in the field were generally lower than the rate settings, and indicated a rough pyramidal profile with the highest rate near the tractor centerline. The low field collected rates were believed due to particles bouncing away from the tops of collection tray partitions. Sieve analysis indicated that, with blended fertilizers, the larger particles were distributed fairly evenly across the spreading width, whereas smaller particles were concentrated in the one-half of the spread width closest to the tractor centerline.

Chemical analysis indicated that the actual chemical composition of samples of 17-17-17 fertilizer was quite consistent over the full lateral spread width. Seed counts revealed that most seeds were concentrated within the center one-half of the spread width.

Performance testing was also commenced for an Overum Tive pneumatic boom type fertilizer spreader.

FUNDING: Atlantic Livestock Feed Incentive Program

TITLE: Haemotological and Biochemical Values for Ranched Silver Fox

LEADER: M. L. Connor

OBJECTIVE: To establish haemotological and blood biochemical values at various production stages for ranched silver fox.

PROGRESS:

Blood samples were collected from foxes on 20 ranches throughout Nova Scotia. From each ranch 5 pups were sampled at each of 10-14 weeks of age, 23-25 weeks of age and at prime. As well, five adult fox were sampled once. Thus these represented several growth/furring stages and different management regimes.

The blood samples have been analyzed for several haemotological and biochemical parameters. Statistical analysis is in progress. The results will provide valuable information which may assist in early and more accurate diagnosis of disorders which influence the blood profile.

Cooperators for this project were G. Smith and W. DeWitt.

Funding by the Canada Fox Breeders Association/Fur Institute of Canada.

TITLE: Mower-Conditioner Performance Analysis

LEADER: F. Desir

OBJECTIVE: To assess the effects of five mower-conditioners on the drying time of grass and legume crops.

To assess the amount of crop loss from the operation of the five mower-conditioners in the grass and legume crops.

PROGRESS:

EXPERIMENTAL PROCEDURE

Five mower-conditioners and one mower (six machines) were tested in three fields; red clover, reed canary and alfalfa. Following are the machines used:

A. KUHN FC 250, disc mower, comb type flail conditioner, operating width 2.5 meters.
B. JOHN DEERE 1326, tine type impeller flail conditioner, operating width 2.4 meters.
C. KIDD CLIPPER 240, drum mower, nylon intermeshing twin rotor brush conditioner, operating width 2.4 meters.
D. HESSTON 1040, disc mower, crimping (rubber vane) roller conditioner, operating width 2.3 meters.
E. VICON KM 281, disc mower, crimping intermeshing roller conditioner, operating width 2.8 meters.
F. KRONE AM 241 disc mower (control), operating width 2.4 meters.

The experiments were done on second cuts of a red clover field in Onslow, July 24-26, 1988; a reed canary field in Old Barns, July 27-28, 1988; and an alfalfa field on the NSAC farm in Truro, July 29-30, 1988. The red clover experiments had to be abandoned because of rain. The other two crops served to represent both grass (the reed canary) and legume (the alfalfa) crops.

A test area of approximately 1.5 hectares in each field was divided into four equal replicates or blocks. The six machines were then operated in a random sequence in each block, to give six runs per block. At two random locations along each run, a full width sample of the windrow 1.5 meters long was placed onto a tray, in such a way that its physical condition was as similar to that of the windrow as possible. The trays were 1.5 meters square, made of 25 mm wire mesh on a wooden frame 76 mm high.

At two other locations along each run, a section of the windrow was carefully lifted away, and all loose crop within a 1.0 meter square frame placed on the ground was collected for crop loss determination. Samples were also taken from the standing crop for yield measurements.

As soon as a sample was placed on a tray, crop samples were taken for initial moisture content determination, and the tray was tagged and weighed. All trays were moved to a common location in the field so that the samples would have similar drying conditions.

Trays were re-weighed at four-hour intervals till dusk on the day of cutting, and through the next days until the crop was dry enough for baling (about 35%-40% moisture content). After the last weighing, crop samples were taken from each tray for final moisture content determination.

The data obtained from the sample weight and moisture content measurements were computed and analyzed by statistical analysis of variance method. Duncan's New Multiple Range Test was used to test for differences between machines.

RESULTS AND DISCUSSION

In both the reed canary and alfalfa fields, the crops dried to a moisture content of about 30% (wet basis) within 40 hours of cutting. For each sample the time (in hours) required for crop moisture content to drop to 35% (wet basis) was computed. This represented the drying time for this sample. When these times were analyzed, it was found that there was little statistical difference between the drying times obtained from different mower-conditioners.

Drying rates for all samples were plotted as graphs of moisture content against time. In the alfalfa field, all machines attained 35% moisture content with only two hours difference between the fastest and the slowest, in the following order: Kuhn, Vicon/John Deere, Krone, and Kidd/Hesston. Only in the reed canary field was the mower significantly slower than the mower-conditioners. Again there was a two-hour gap between the fastest and slowest mower-conditioner, in the following order: Kidd, Kuhn, John Deere/Hesston, and Vicon.

Crop loss in the reed canary field was found to be negligible for all machines. In the alfalfa field, crop loss ranged only between 0.5% and 5% of crop yield. The highest was obtained from the Kuhn, followed by the John Deere, Kidd, Hesston, Vicon and Krone.

CONCLUSIONS

From these results it can be concluded that the mower-conditioners tested were only marginally different from each other in terms of crop drying rate. Differences were more significant when crop losses were considered, but only in the alfalfa trials. Crop losses were negligible in the reed canary trials. The flail type conditioners were more aggressive than the roller types, confirming previous experimental results.

This project funded through ALFI TD01

TITLE: Ovulation Rate and Early Embryonic Survival in Gilts

LEADER: M. L. Connor in cooperation with T.. A. VanLunen of Research Branch of Agriculture Canada, Experimental Station, Nappan, N. S.

OBJECTIVE:
1. To determine if ovulation rate changes from first through third estrus in gilts.
2. To determine whether ovulation rate at first, second or third estrus influences embryonic survival in gilts.

PROGRESS:

The concept that ovulation rates increase from first through third estrus in gilts has been the basis for practical breeding recommendations. Two trials were conducted to determine 1) if a change in ovulation rate occurs from the first through third estrus and 2) the effect of ovulation rate at the first, second or third estrus on early embryonic survival in gilts. In trial 1, two replicates each with 72 Yorkshire gilts were conducted. Half of the gilts were restricted to 0.5 kg of feed/gilt/day from 160 to 164 days of age and the others were fed ad lib. Daily boar exposure began at 165 days of age. Reproductive tracts were collected from gilts slaughtered 10 to 12 days following their first (puberal; 1st), second (2nd) or third (3rd) estrus. Uterine weights, ovarian weights, and corpora lutea (CL) weights increased with each successive cycle. Ovulation rates as determined by the number of CL, were similar at each estrus in both replications (15.1 $\pm$ 5.2; 15.2 $\pm$ 2.7; 14.9 $\pm$ 4.2 for 1st, 2nd and 3rd estrus respectively; rep 1). In trial 2 the protocol was basically the same except that gilts were mated at either their 1st, 2nd or 3rd postpubertal estrus and slaughtered 30 days later. Reproductive tracts were collected and in addition to data collected as per trial 1, embryos were flushed, counted and weighed. Mean ovarian weight, CL weight and CL numbers were similar across the groups. Early embryonic survival in rep 1 was similar from each estrus [12.1 $\pm$ 2.3 (n=14); 11.0 $\pm$ 1.2 (n=8); 10.1 $\pm$ 2.9 (n=8); estrus 1, 2 and 3 respectively] and in rep 2 for 2nd (6.9 $\pm$ 1.7; n-14) and 3rd estrus (7.4 $\pm$ 6.1; n=11). In trial 2 rep 2 the first estrus did not have sufficient gilts to compare with the above values. In conclusion ovulation rate did not change from the first through third postpubertal estrus. Similarly, early embryonic survival in gilts did not seem influenced by the postpubertal estrus at which mating occurred.

FUNDING: Agriculture Canada and N. S. A. C. Farm joint sponsorship for animals, feed and labour.

TITLE: Digital Image Analysis of Cow Shape and Relationship to Type Evaluation

LEADER: D. L. Patterson

OBJECTIVE: To examine the feasibility of using computerized image analysis techniques to more objectively evaluate the conformation of dairy cattle.

PROGRESS:

A total of 166 registered Holstein cows with official type classification from seven different herds have been photographed to date. At least eight black and white photographs were taken of each animal, including side views, top and front views, and close-ups of the mammary system and feet and legs. An indicator of scale was included in each photograph. Each cow was measured for hip and wither height, heart girth, and pin-shoulder distance.

The photographs are digitized using the Bioquant System IV™ (R. & M. Biometrics Ltd., Nashville, TN). Measurements taken include those corresponding to the actual measurements on the animal, distances between various anatomical points, areas such as udder area, and angles such as those from hooks to pins and placement of udder. Measurements were chosen to correspond to those evaluated subjectively on each cow under the official type classification. The repeatability of taking measurements off the photographs is high, and the correlation between digitized measurements and actual body measurements is good if anatomical reference points can be located.

Since the stance of the animal affects the measurements, a sample of the cows are being videotaped as they move around on a flat surface. This technique will allow 'grabbing' an image at the instant the animal appears to be standing normally and comparing this to other stances. The actual cost of videotaping is considerably less than that associated with taking photographs of the animals.

Some photographs still remain to be digitized, and the statistical analysis of the project is not yet done. Once this is complete the relationship of these measurements to the official classes can be determined and an assessment made of the technique in quantifying dairy conformation.

This project was funded by the Canadian Association of Animal Breeders.

TITLE: Fur Clipping in ranched silver foxes - a survey

LEADER: T. Tennessen

PROGRESS:

A questionnaire was sent to 100 fox ranchers from Newfoundland to British Columbia. Thirty-seven ranchers completed and returned the questionnaire. The severity of the problem ranged from 5% (3 animals) being affected to 70% (210 animals).

A second survey will be taken this fall. Some general information from the preliminary survey follows:

1. Fur clipping occurred most commonly on the tips (37%). The other areas commonly affected included back (18%), rump (15%), shoulders (12%), sides (12%) and a small number of other areas (6%).

2. Fur clipping occurred just as frequently among foxes housed one per pen as among those housed two or more per pen.

3. Fur clipping was reported both on ranches feeding a wet locally prepared ration and on those feeding commercial dry fox feed. Among those feeding dry commercial ration, all three major feed companies (Purina, National, Master) were represented.

4. Respondents reported that of those foxes showing fur clipping, 22% were more nervous than average, while 78% were normal. No one reported that the clippers were less nervous than average.

5. There was no relationship between pen size and frequency of fur clipping.

This study was funded by Canada Fox Breeders Association.

TITLE: Effect of boron foliar spray on thiocyanate content and growth of 'Early Snowball' cauliflower and 'Imperial Comet' broccoli

LEADER: H.-Y. Ju

OBJECTIVE: To study the effect of boron on thiocyanate content and growth in cauliflower and broccoli

PROGRESS: Five-week-old 'Early Snowball' cauliflower and 'Imperial Comet' seedlings were transplanted from 10 cm pots to 20 cm pots containing vermiculite. Each pot was watered daily and fertilized twice weekly with full strength Hoagland's solution and Hoagland's micronutrients with 0.1 ppm boron (250 ml/pot/watering) until curd reached "thumb" size. At that time the boron was removed from the nutrient solution. After one week the plants were foliar sprayed with solutions containing six boron concentrations (0, 0.1, 1.0, 10.0, 100.0, 1000.0 ppm) obtained by varying amounts of H_3BO_3. The experiments were arranged in a randomized block design with four replications. Ten days after the treatments the plants were harvested. Growth measurements were taken and thiocyanate content in the curd were determined.

There was no significant difference among the treatments with respect to plant growth. The lowest levels of thiocyanates were determined in the plants treated with 1000 ppm B. The amounts at 912.8 and 691.7 µg/g DW were recorded for cauliflower and broccoli respectively, where 1397.1-1827.4 and 833.6-3288.1 µg/g DW were determined for cauliflower and broccoli respectively for the treatments of 0-100 ppm B.

This project was supported by NSERC.

TITLE: The Effects of Paclobutrazol (PP333) on the Growth and Physiology of Lowbush Blueberry

LEADER: J.C. Lewis and H.-Y. Ju

OBJECTIVE: To study the effects of PP333 on the growth and yield of lowbush blueberry

PROGRESS: The macroscopic effects of PP333 are characterized by reduction of shoot extension and the increased production of flower buds in lowbush blueberry. This is true for both sprouting year and 1st fruiting year applications and results in significant yield increase with a foliar application of 1000 ppm.

The study screened five plant growth retardants against a distilled water control, applied as foliar sprays until "drip" to commercial field lowbush blueberry in Bible Hill, N.S.. The experiment was subdivided into two experiments, one with application to the sprouting year and the other to the fruiting year of a two year management cycle.

Randomized complete block designs with 4 replications were used. The growth retardants (daminozide, 2500 ppm; chlormequat, 1500 ppm; ethephon, 500 ppm; mepiquat chloride, 100 ppm; paclobutrazol, 1000 ppm and the distilled water control were applied on July 8, 1986, to the sprouting year plants and June 19, 1986 to the fruiting year plants.

The 1987 yields from the 1st fruiting year crops (sprouting year application) were 157.0 grams/40 x 40 cm. quadrat compared to 93.1 grams for control plots. This was significantly greater (5% level) and translates into a yield benefit of 69%. Yields from the 2nd fruiting year crops (1st fruiting year application) were 109.8 grams/40 x 40 cm. quadrat compared to 40.1 grams for control plots. This was also significantly greater (5% level) by 173% but more importantly was greater than the control 1st fruiting year yield of 93.1 grams/quadrat. This has important implications in a 3-year production cycle with two productive fruiting years.

The physiological basis for these effects were investigated in a greenhouse experiment using potted "Chignecto" lowbush blueberry clones. This experiment suggested PP333 increases chlorophyll concentration in the leaves of treated plants and similarly improves photosynthetic activity. These suppositions were based on chlorophyll extraction and chlorophyll fluorescence work respectively.

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